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in the woods, the sides of which had badly slumped The dumps were partially overgrown Several typical nodules of the wavellite ore were found in the pit, while the dumps afforded several boulders of limonite which contained wavellite, strengite, barrandite, variscite, beraunite, and cacoxenite No manganese minerals were seen

Wavellite—The wavellite ore is typically grayish-white and massive; nodular or botryoidal Small areas of colorless radiating crystals sometimes occur in the massive material Radiations of crystals were found also in cavities and fractures in the boulders of limonite, associated with the other phosphates One specimen showed acicular crystals implanted upon the drusy surface of variscite globules Crystals of wavellite from this mine were described by Ungemach[7] in 1912, who gave the locality as Cly, York County, which was the site of the phosphorus factory

The wavellite crystals showed the following indices of refraction for Hg yellow light

Optically +, $\alpha = 1\ 525$, $\beta = 1\ 535$, $\gamma = 1\ 552$, $\gamma - \alpha = 0\ 027$

Beraunite.—The "beraunite" occurs as brownish red, translucent, resinous, indistinct crystals in radiating aggregates They are almost invariably associated with cacoxenite (the later mineral) in fractures in massive limonite

The Moore's Mill mineral differs greatly in optical properties from eleonorite, as may be seen by comparison with the data given by Larsen[8] for beraunite (eleonorite) from Giessen, Germany

		Moore's Mill	Giessen
Optically		—	+
α		1 607	1 775
β		>1 74	1 786
γ		<1 78	1 815
$\gamma - \alpha$			0 040
Pleochroism	X	Aniline yellow	Pale flesh color to colorless
	Y	Maize yellow	" " " " "
	Z	Orange	Carnelian red to vinaceous
2V		Large	Medium large
Extinction		Wavy, straight?	Y c = 1 5°

Cacoxenite—The cacoxenite occurs as radiations of acicular crystals Individual crystals are orange yellow, but the complete radiating aggregates are dark brown, as the ends of the crystals are then chiefly visible. Some translucent dark red globules on one specimen showed the same optical properties, and are perhaps also cacoxenite The cacoxenite is almost invariably associated with the "beraunite," in fractures in massive limonite

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[7] Bull Soc franç Min 35 536 1912

[8] U S Geol Surv. Bull 679 46, 1921

The cacoxenite showed the following optical properties

Optically +, ω = 1 480 — 1 485, very pale yellow
ϵ = 1 635, pale yellow

The ends of the needles show somewhat higher indices

Variscite —A single boulder of limonite was found containing cavities lined with colorless variscite[9] The variscite is water-clear, and forms mammillary aggregates, with a fibrous structure Each spherule shows a faceted surface A few cavities showed druses of minute prismatic crystals, measuring up to 05 × 0 1 mm

The optical properties are compared below with variscite

	Optically	α	β	γ	$\gamma - \alpha$
Moore's Mill	—	1 575	1 595	1 610	0 035
Lucin, Utah[10] ("Lucinite")	—	1 563	1 585	1 592	0 029
Striegis[10] ("Peganite")	—	1 562	1 583	1 587	0 025
Striegis ("Peganite")	—	1 570		1 595	0 025

The variscite shows straight extinction, and positive elongation Adopting Schaller's crystallographic orientation (see below), the optical orientation is $X = b$, $Y = a$, $Z = c$

Two tiny crystals were measured on the goniometer The habit is prismatic (Figure 2), and the forms present were *a* (100), *c* (001), *d* (120), and *p* (111), all smooth and bright

a b c = 0 8723 1 0 9788, p_0 = 1 1225 ("Lucinite", Schaller)[11]

Letter	Form	Measured		Calculated	
		φ	ρ	φ	ρ
		° ′ ′	° ′ ′	° ′	° ′
p	(111)	48 51 ± 12	56 15 ± 16	48 53	56 06
d	(120)	30 12 ± 5	90 00	29 48	90 00

A good prismatic cleavage was noted

Barrandite and *Strengite* —Several specimens show many spherules with a somewhat greasy luster, and radiating fibrous structure Their color is grayish white or yellowish Not infrequently there is also a concentric structure, with colorless and white bands. They are found to occur with "beraunite" and cacoxenite in fractures in limonite.

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[9] At the meeting of the Mineralogical Society of America in December, 1923, Larsen and Schaller stated that peganite, variscite (excepting from Lucin, Utah), and lucinite were identical, but that the "variscite" from Lucin, Utah, was different The latter they have named metavariscite Am Min 9 69, 1924

[10] Larsen, U S Geol Surv Bull 679, 118 and 102, 1921

[11] U S Geol Surv Bull 610 59, 1916

As may be seen below, they are optically identical with barrandite or strengite. Sometimes both may be present in a single spherule.

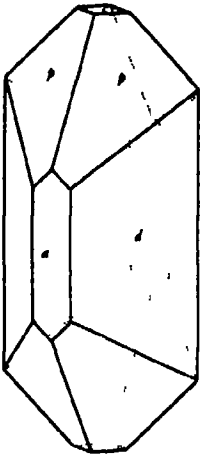

Fig. 2

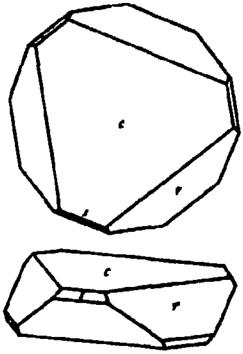

Fig. 3

Locality	Mineral	Composition	Elongation	α	γ	γ—α
Moore's Mill	Variscite	$Al_2O_3\ P_2O_5\ 4H_2O$	+	1.575	1.610	0.035
" "	Barrandite	$(Fe, Al)_2O_3\ P_2O_5\ 4H_2O$	+	1.650	1.675	0.025
Cerhovic	"	"	+	1.650	1.680	0.030
Moore's Mill	Strengite	$Fe_2O_3\ P_2O_5\ 4H_2O$	+	1.697	1.735	0.038
Giessen[12]	"	"	+	1.708	1.745	0.037

Strengites from other localities usually contain manganese, are colored, and pleochroic. That strengite and variscite are isomorphous may be seen in comparing their axial ratios.

Variscite[13] ("Lucinite") a : b : c = 0.8729 : 1 : 0.9788
Strengite[14] a : b : c = 0.8663 : 1 : 0.9776

From the optical properties of the spherules, it would seem that they form mixed crystals, and that barrandite is an intermediate compound.

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[12] Larsen, U. S. Geol. Survey Bull. 679: 138, 1921.
[13] Schaller, U. S. Geol. Surv. Bull. 610: 59, 1916.
[14] Steinmetz and Laubmann, Zeit. Kryst. 55: 545, 1920.

Globosite.—Globosite was described by Breithaupt[15] from the Arme Hilfe mine near Hirschberg, where it occured as wax-yellow to yellowish-gray globular concretions; streak white, luster greasy to adamantine, $H = 5 - 5.5$; specific gravity 2.825. An analysis showed it to be essentially a hydrous ferric phosphate, the percentages of Fe_2O_3 and H_2O are close to strengite, but the P_2O_5 is low. No reliance can be placed in the analysis. The specific gravity approaches that of strengite, while the greasy or adamantine luster would indicate a mineral of fairly high indices of refraction. It has not been possible to secure a specimen from the type locality for the determination of the optical properties. It is probably identical with strengite.

3. OPTICAL PROPERTIES OF BARRANDITE FROM BOHEMIA.

The specimen of barrandite from Cerhovic, Bohemia, in the William S. Vaux Collections, shows a number of spheroids with a radiating fibrous structure. The color of the spheroids is a dirty white to reddish, due to staining by limonite. A cross section of a spheroid shows the fibers to be clear and colorless at the outer margin, and also at the core of the spheroids; between the core and margin the fibers are white, with a somewhat pearly luster on the cleavage.

The spheroids occur on a fine-grained sandstone composed of reddish stained to colorless quartz, with grains of an unidentified green mineral.

The white fibers show straight extinction, with positive elongation. The indices of refraction are.

$$\alpha = 1.650, \quad \gamma = 1.680, \quad \gamma - \alpha = 0.030, \quad \text{all} \pm .005$$

4. JAROSITE FROM MIDVALE, VIRGINIA.

On a visit to the dufrenite and strengite locality, one mile southeast of Midvale, Virginia, in 1919, some minute brownish-red crystals of jarosite were obtained. The locality was described in the American Mineralogist, V, 197, 1920.

The specimens consist of a brecciated ferruginous sandstone, with veins of dufrenite. Small cavities in the dufrenite were lined with a greenish mineral, perhaps cacoxenite, some faintly violet-tinted crystals which may be strengite, and minute (0.5 mm.) brownish-red trigonal crystals of jarosite. Another specimen showed these crystals upon radiating goethite in a cavity of the ore.

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[15] Berg- und hüttenmannische Zeitung, 24: 321, 1865.

The jarosite crystals are translucent, but quite brittle. They are combinations of c (0001), r ($10\bar{1}1$), and s ($02\bar{2}1$). The forms c and r are sometimes equally developed; s is narrow. There is a good cleavage parallel to c (0001) with a somewhat pearly luster. The other faces show a resinous luster. A number of crystals were measured. The average of 9 measurements of $c : r$ ($0001 : 10\bar{1}1$) was 53° 12′, limits 51° 14′ to 54° 41′; the angle of $r . r$ is then 87° 48′, and the axial ratio $c : a = 1.158$.

There is great uncertainty in the axial ratio of jarosite. The data given in Dana's System of Mineralogy: $c : a = 1.249$ ($c : r = 55°\ 16'$, $r : r = 90°\ 45'$) represent the values given by Koenig[16] for a single measured crystal from Chaffee Co., Colo. Cesàro,[17] obtained for jarosite from South Dakota $c : a = 1.169$, while Schaller[18] obtained $c : r = 53°\ 19'$ ($c . a = 1.163$) for crystals from Bisbee, Arizona. The latter is the mean between the ratios of Cesàro and the writer.

Basal sections of the mineral show a good uniaxial figure, optically negative. The indices of refraction are

$\epsilon = 1.706$, nearly colorless
$\omega = > 1.78$, pale yellow

Upon fusion with sodium carbonate and charcoal, a mass was obtained which stained a silver coin.

A few specimens were found of an altered dufrenite containing cavities with small brownish red prismatic crystals. Crystallographic measurement indicated them to be strengite. Upon breaking the crystals for optical examination, it was seen that the red color was a thin coating on the surface, the interior of the crystals being colorless and transparent. The coating is perhaps jarosite.

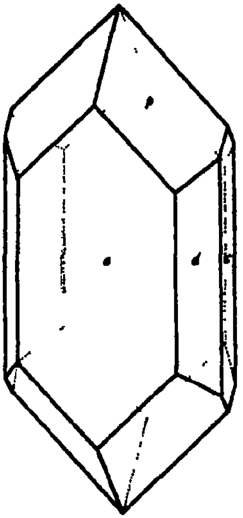

Fig 4

The habit is shown in Figure 4. The forms present were a (100), c (010), d (120), and p (111).

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[16] Am. Chem. J. 2: 375, 1880.
[17] Bull. Acad. Sci. Belge, 137, 1905.
[18] U. S. Geol. Surv. Bull. 610: 136, 1916.

5 ALUNITE, FROM LLALLAGUA, BOLIVIA

While at Llallagua, in 1921, the foreman of the mines presented the writer with a white massive mineral about 12 cm in diameter Subsequent examination indicated it to be alunite, $K_2O\ 3Al_2O_3\ 4SO_3\ 6H_2O$ Some of this material has been distributed under the name of sphaerite

The alunite is compact, white, and porcelain-like It scratches glass readily The specific gravity is 2 726 The mean index of refraction is 1 580, with low birefringence.

The mineral is insoluble in HCl Upon fusion with sodium carbonate a slag was obtained which stained a silver coin, after moistening with water The fused mass was dissolved in dilute HCl, and the solution yielded precipitates with $BaCl_2$ (indicating it to be a sulfate), and upon the addition of NH_4OH (aluminium)

No data were obtained regarding the mode of occurrence of the mineral, but it probably represents an alteration of the rhyolite adjoining the tin veins

6. RHOMBOCLASE, FROM CERRO DE PASCO, PERU

Rhomboclase was described by Krenner[19] in 1891, from Szomolnok, Hungary, where it occurs with other iron sulfates It has since been artificially prepared and studied by Scharizer,[20] and Posnjak and Merwin [21]

This rare mineral occurs in abundance in the abandoned stopes (300 foot level) of the Esperanza mine, at Cerro de Pasco, Peru. The pyritic ore body in the vicinity of this stope is in a smoldering condition; and the roof and floor of the stope and adjoining tunnels, are covered with stalactites and stalagmites of the sulfates mentioned below

The most striking minerals were the large stalactites, up to a meter in length, studded with crystals of chalcanthite and iron-copper chalcanthite These were clear blue, but the latter altered rapidly upon exposure to the air at the surface. The interior of the iron-copper chalcanthite specimens altered to a pale blue, while various sulfates formed thin crusts on the outer surface of the stalactites

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[19] Akadémiai Értesítö, Budapest, 11 86, 1891 (through Min Mag. 15 429, 1910)

[20] Zeit Kryst 35 345, 1901, 43. 113, 1907, 56. 353, 1921

[21] J Am Chem Soc 44: 1983, 1922

The rhomboclase formed stalagmites, with a radiating bladed structure, on the floor of the stope The largest specimen measured 15 centimeters across, but this was formed of two coalescing stalagmites The color of the rhomboclase was light yellow in the mass, but the presence of copper or iron salts in minute quantity frequently gave, locally, greenish or bluish tones. Crusts of minute roemerite crystals sometimes occurred about the base of the rhomboclase stalagmites. The rhomboclase agreed in the indices of refraction, and other optical properties with the data given by Posnjak and Merwin

Stalagmites of epsomite were not of infrequent occurrence on the floor of the stope They were colorless and perfectly translucent, and measured up to 17 × 6 cm in size At the surface, however, they rapidly dehydrated to a chalk-like mass, with a radiating fibrous structure

Elsewhere in the Esperanza mine, efflorescences of white, acicular goslarite frequently were found on the walls of the tunnels

7 PYROMORPHITE, FROM BROKEN HILL, N S W

A specimen from Broken Hill, N S W given to the writer for identification by Mr Frank J Keeley, proved to be pyromorphite of unusual development The specimen consists chiefly of quartz, covered with some cellular limonite On the limonite are small (rarely more than 1 mm) brilliant, doubly terminated, colorless to pale buff, transparent crystals of pyromorphite The crystals are combinations of *a* (10$\bar{1}$0), *m* (10$\bar{1}$1), and *r* (11$\bar{2}$1), as determined by measurement on the goniometer The relative development of the faces is shown in Fig 5

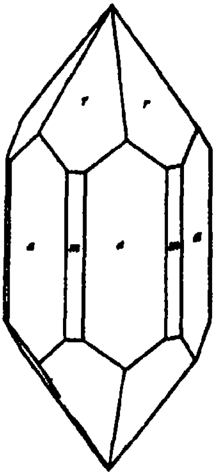

Fig 5

8 THE PROBABLE IDENTITY OF CHLOROTILE WITH MIXITE

Chlorotile was described by Frenzel,[illegible] from Schneeberg, Saxony, as minute capillary crystals, pale green to emerald green in the mass, with the composition $Cu_3As_2O_8\ 6H_2O$.

[illegible] Min Mitth 42 1875, Jb Min 517, 1875

Optical examination of two specimens in the William S. Vaux Collections showed the mineral to be uniaxial, +, birefringence high, ϵ much greater than 1.74, $\omega = 1.735 \pm .005$. The mineral was but slightly pleochroic.

As these data indicated an identity with mixite, a test was made for bismuth. A small quantity of the mineral was heated with a mixture of KI and S, before the oxidizing flame of the blowpipe. A bright red coating was obtained at some distance from the assay, indicating the presence of much Bi.

9. THE PROBABLE IDENTITY OF SCHOEPITE WITH BECQUERELITE.

Becquerelite was described by Schoep,[13] in 1922, from Kasolo, Belgian Congo, as a brownish yellow, orthorhombic mineral, with a resinous luster, and the formula $UO_3 \cdot 2H_2O$. The prism zone angles were within 1–2° of 60°, and twins of the aragonite type were common. The axial ratios were $a : b : c = 0.426 : 1 : 0.875$.

The name schoepite was given by Walker[14] to some sulfur-yellow crystals, adamantine in luster, resembling the becquerelite of Schoep. Optical details were given, but there was apparently insufficient material for a chemical analysis.

Subsequently Schoep[15] made an analysis of schoepite and found the composition to be identical with becquerelite. Crystals of becquerelite were measured, and the following axial ratios obtained $a : b : c = 0.5722 : 1 : 0.6173$. On the basis of these data, and an apparent difference in optical properties, it was concluded that schoepite and becquerelite were dimorphous forms of $UO_3 \cdot 2H_2O$.

By reorienting the two minerals, an identity can be shown. Adopting the schoepite orientation, the forms *c* (001), *a* (100), *b* (010, (021), (101), and (102) of becquerelite become respectively *a* (100), *b* (010), *c* (001), (205), (4.10.0), and (450). The axial ratios then become:

	a	b	c
Schoepite	0.426	1	0.875
Becquerelite	0.432	1	0.874

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[13] Compt. rend. 174 (19). 1240, 1922.

[14] Am. Min. 8, 67, 1923.

[15] Bull. Soc. Belge Géol. 33 (2). 174, 1924.

10. An Error in the Recorded Optical Properties of Daviesite.

In view of the marked tendency to perpetuate errors in text-books and reference works, this note is presented to call attention to some optical data given in Larsen's Tables[26] for "daviesite" An inspection of the following table will show that the specimen he examined was actually caracolite. The optical properties of daviesite are therefore, as yet, unknown.

Caracolite[27]		"Daviesite"[26]	
Caracoles, Chile (A M N H)		Mina Beatriz, Sierra Gorda, Mexico (should be Chile) (Col Roebling)	
Water clear, glistening crystals		Clear crystals and fibers	
Optically —		Optically +, may be —	
2V nearly 90°		2V nearly 90°	
$\rho > \nu$ (rather strong)		$\rho > \nu$ (rather strong)	
α 1 743	± 005	α 1 744	± 003
β 1 754		β 1 752	
γ 1 764		γ 1 760	

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[26] U S Geol Surv Bull 679 66 and 230

[27] *Ibid*, 52 and 269

TRACHELOMONAS: NEW OR NOTABLE SPECIES AND VARIETIES

BY T. CHALKLEY PALMER

Since the publication of a paper entitled "Delaware Valley Forms of Trachelomonas" (6), I have made occasional collections from the waters of the valley, with the hope of taking some or all of the species not given in my list, but published by Dr A. C Stokes as occurring in approximately the same territory (8, 9, 10, 11) In Tinicum ditches I have seen isolated specimens of *T. sphaerica* Stokes, and a number of loricae classifiable as small forms or varieties of *T. spinosa* Stokes *T verrucosa* Stokes, recorded and figured in my paper, has recurred occasionally, but it seems to be quite rare Others among those species I have not been so fortunate as to find, and no doubt *T. similis*, *T obovata* *T fusiformis*, *T acanthophora*, are all to be classed as rarities *T cervicula* Stokes, later reduced by Lemmermann to varietal status under *T volvocina*, is no doubt one form referred to in my paper under this same species It is to be seen frequently, and I am not at all certain, after considerable acquaintance with it, that it ought not to be restored to the dignity of a separate species.

Meantime, at least one undescribed form has appeared in these waters and elsewhere, and collections made at intervals from the upland waters of about twenty ponds in southeastern Pennsylvania have yielded a variety of puzzling forms needing further study, together with some evidently new, and a few recorded previously from distant regions

Very interesting facts as to distribution emerge from a study of this material in connection with the abundant and important recent literature on *Trachelomonas*, cited below only in part Adequate treatment of this subject, however, is not at present possible A real delimitation of species and varieties in this genus awaits a detailed study, not of the loricae only, but also and especially of the living monads Loricate characters only are known for many species, and in some published descriptions even these are not too definitely recorded Moreover, something is still to do in the way of a more critical investigation of the mineral constituents of certain loricae. But above all, the monads call for a real comparative study. Certain authors have made a beginning, but progress is difficult owing to the chronic scarcity of material It must therefore be understood that specific distinctions at present are more or less tentative[1]

In general it would seem that even so-called rare species, wheresoever first discovered, are apt to reappear at the antipodes An illustration of this is seen in the case of the Brandywine ponds near Chadd's Ford, Pa In addition to species apparently undescribed, though of close affinity with forms recorded from other regions, we get here such outlanders as the Australian *T scabra* Playfair (7), and *T Schauinslandii* Lemmermann (5) known only hitherto from Siam Conversely, *T. verrucosa* Stokes (8), a rare species of the Delaware Valley, is now figured and described by Playfair among the Australian species This "cosmopolitanism" of *Trachelomonas* is commented upon by Swirenko in his account of Russian species (12) It is of course especially in evidence in the case of species like *T. volvocina* and *T hispida* But in these, as might easily be predicted, there is manifest a tendency toward the formation of local races, each one of which has its own peculiarities Hence the multiplication, already referred to, of varietal names under these species Hence also a certain amount of confusion and doubt as to the specific validity of certain forms An intensive study of gatherings from local ponds reveals this tendency in operation on a small scale, and an exposition of this matter might no doubt be made interesting But at present I confine myself to the following descriptions and accompanying notes

Trachelomonas nexilis sp nov Plate I, figure 1

Lorica brown, nearly spherical, the thick wall composed of an inner pellicle covered with a complex network of crowded, winding ridges Aperture not produced, a minute tube in a slight depression Monad with green chromatophores and red pigment spot Flagellum about 60 µ long Diameter of lorica 20 µ.

Fresh-water tidal ditches. Tinicum, Pa September, 1923.

Collected at Long Hook and at Lester, in both cases in association with *T. volvocina* An attentive study of a large number of loricae shows that at times the lacunae of the network are scaled over with a tenuous outer pellicle Very old specimens, of quite dark color, still show the network on careful focusing, and optical sections of such loricae give pictures in marked contrast to those of *T volvocina* at a similar stage This network branches out from a smooth area about the aperture This same species was also collected in considerable numbers in 1924 at Penn Valley, Bucks Co, Pa, and at Ogden, Pa It has also been detected in some upland ponds

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[1] As a case in point, two of the species described below were at first viewed by me as varieties of *T volvocina* Ehr , but on reconsideration I believe there is no call for such excessive caution These loricae at apparent maturity are just as different from typical *T volvocina* as is *T rugulosa* Stein, now accepted as a species, but formerly considered as a mere variety *T volvocina* is already loaded down with at least nine named varieties *T hispida* (Perty) Stein has that many, or more, and it would be an easy task to increase the number

Trachelomonas columba sp nov Plate I figure 2

Lorica lucent brown, nearly spherical, surface separated into large irregular areas by high, straight or curved, smooth ridges Aperture a minute tube slightly produced Monad green, with red pigment spot and long flagellum Diameter of lorica 18–24 μ

Pond water Dove's Mill, Pa September, 1924

Collected in small numbers, together with varieties of *T volvocina*, in a large lily pond In October of the same year it was taken more plentifully, but in less mature condition as to lorica, in a rich gathering of *T volvocina*, *nexilis*, *crebea*, *hispida* and other species, at Ogden, Pa These immature loricae, some of them nearly colorless and with variable surface markings, tend to raise the question whether we have here merely another variety or condition of *T volvocina* But in the same gathering, and in many others, one may see loricae of the latter in a similar stage of immaturity, and these give no indication of a surface diversified with ridges as described above. The Dove's Mill gathering showed a single lorica of *T volvocina* var. *cervicula* (Stokes) Lemm, with wrinkled surface, but I cannot think this circumstance fatal to the specific rank of this strongly marked form

Trachelomonas flava sp nov Plate I, figures 3, 3a

Lorica brownish yellow, oblate-spheroidal, wall of medium thickness, surface polished, beset sparsely and at random with very short, hollow papillae or blunt spines Aperture minute, a conical tube in a narrow depression Monad with green chromatophores, red pigment spot and long flagellum. Length of lorica 8–9 μ breadth 12–15 μ.

Pond water. Chadd's Ford, Pa. September, 1924.

Among the known species with oblate loricae, the Javan *T bernardi* Woloszynska (13) would seem most nearly to resemble this. It is described as being 10–15 μ long, 15–18 μ broad, and yellow-brown in color But it is without the peculiar small papillae In this Chadd's Ford form, the wall is seen in optical section to be double, the inner, more dense layer penetrating the outer in hollow extensions to form the papillae Another oblate species is the Australian *T lismorensis* Playfair (7) This is a larger form, with very long, regularly arranged spines Of this there is a var *inermis* Playfair, without spines, 18 μ long, 22 μ broad. I am unable to class my specimens with either of these Indeed, Playfair implies that his var *inermis*, when seen from the top, is easily mistaken for *T. volvocina* It is therefore doubtless thick walled and so of another type The Belgian *T. Kufferathi* Conrad (2), also oblate, is much larger, with a few short spines, but with a wide, elongated aperture and a caudal process

Trachelomonas depressa *sp nov* Plate I, figures 4, 4a

Lorica reddish brown, oblate-spheroidal, wall thick, surface dull Aperture a minute inward-pointing funnel, surrounded by a slightly sunken, broad, polished ring of a diameter equal one-third that of the lorica Monad green with red pigment spot and long flagellum Length of lorica 16 μ, breadth 20 μ

Pond water Chadd's Ford, Pa September, 1924.

Collected with *T flava* described above, with which it is in marked contrast as to all features except the polar flattening Both were taken in considerable numbers, but only on one occasion.

This species separates itself from all varieties of *T volvocina* known to me by the shape of the lorica, the funnel-form aperture, and the relatively large polished ring *T lismorensis* var *inermis* Playfair, discussed above, seems close, but so far as can be judged from figure and description, it is without the peculiar aperture and ring The Brasilian *T curta* daCunha (3) is only slightly flattened at the poles, and it is much larger (30 μ long, 32 μ broad). The figure accompanying the description indicates also a projecting collar around the aperture.

Trachelomonas beyeri *sp nov* Plate I, figure 5

Lorica pellucid, yellow brown, nearly spherical, surface covered with broad-based, hollow spines, uniformly about 1 μ high, evenly spaced in diagonal lines Aperture a minute tube seated in a slight depression. Monad green, with small pigment spot. Flagellum about 30 μ long Diameter of lorica 9–13 μ.

Pond water. Willistown, Chester Co, Pa. October, 1922.

First found in large numbers in a lily tank at Westtown School, Pa., with other euglenoid species Here, however, all the loricae, as well as those of accompanying *T volvocina, armata*, etc., were poorly developed, perhaps from lack of iron in the water. At the Willistown pond all the species showed normal development. Subsequently I found this species in Brandywine meadows, in a pond at Lima, Pa. and elsewhere, but always in small numbers except at Westtown and Willistown

The Australian *T volvocina* var *granulosa* Playfair (7) 11–12 μ in diameter would seem to approach this, but the processes are not spines nor are they regularly arranged The Russian *T hispida* var. *globularis* Awerinzeu (1) is much larger, and again the arrangement of the spines lacks regularity In fact, I know of no species in the genus with such an array. Under low powers of the microscope the effect is like that of the "beading" of some diatoms. an effect heightened by the vitreous lustre of the lorica

I take pleasure in dedicating this species to Charles S Boyer, F R M S , of Philadelphia, erudite naturalist, author of important works on the Diatomaceae

Trachelomonas terminus sp nov Plate I, figure 6

Lorica chocolate brown, thick walled, ovoid, posterior smaller end slightly flattened Surface rough with papillae and hollow, winding ridges, mostly without definite arrangement Aperture a minute short tube in a slight depression Monad green with red pigment spot Flagellum about 45 μ long. Length of lorica 15 μ, greatest breadth 12 μ

Pond water. Ogden, Pa June, 1923

Collected twice in considerable numbers, at a week's interval, in a small pond close to the Mason and Dixon line Following the happy suggestion of E Wallace Chadwick, Esq , I dedicate it to the ancient God of Boundaries. It differs from familiar species in color, shape, and surface markings It seems nearest in shape to *T. obovata* Stokes (10), which is, however, much larger and minutely hispid The markings in this Ogden form run the gamut from random ridges to papillae, showing a tendency toward diagonal lineation. The older, deeply colored loricae are shaggy with high, confused ridges. The color is apparently always without the rusty tone of the accompanying *T. volvocina, hispida, stokesiana.* When the preparation was ignited on the coverglass, the loricae of this species, composing at least half of the mixture, became opaque, but remained a chocolate brown, with scarcely a tint of the red developed in the others. Nevertheless, an acidified solution of potassium ferrocyanide yielded with them the usual blue cloud due to ferric oxide, though less intense than that, e g., from the loricae of *T hispida* Possibly the lorica is mineralized only in part with iron, the other constituent being perhaps an oxide giving a colorless precipitate with ferrocyanide, and so diluting the cloud

Trachelomonas triquetra Playfair

Proc Linnaean Soc New South Wales, 1925

"Lorica corpore superne exacta rectangulari lateribus rectis paralellis, inferne acuminato lateribus planis rapide ad caudam convergentibus, collo recto brevi, cauda brevi, membrana tenui scrobiculata. Lorica a vertice triquetra Long 40 μ, lat 20 μ "

Trachelomonas triquetra var jaculata var nov Plate I, figure 7.

Lorica nearly colorless, thin walled, surface approximately smooth, adhesive, outline cuneate, the posterior pointed end slightly blunted, cross-section triquetrous with angles rounded Aperture an open tube 6–8 μ in diameter, 4 μ long, the smooth, thin edge not everted Green monad with red pigment spot and long flagellum. Length of lorica 32 μ, greatest breadth 20 μ.

Pond water Chadd's Ford, Pa August, 1923

I venture to class this under Playfair's Australian species, believing the triquetrous cross section to be of large importance It was very scarce, and all the score or so of specimens had nearly the same outline, the same pellucid, tenuous wall Possibly my specimens lacked age, and older loricae may show more color. At the posterior end there is some indication of a relic of a stipe The sticky surface often shows adhering particles of sand, etc

Trachelomonas praeliaris sp. nov Plate I, figures 8, 9.

Lorica spheroidal, thin walled, translucent, colorless to slightly brown-tinted, surface minutely roughened and pitted, adhesive Aperture a wide-open, nearly colorless tube, cylindrical or slightly flaring, the lip everted, often oblique, thin edged, obscurely lacerate Caudal process a nearly colorless spine, with narrow lumen and sparsely dotted surface, straight or slightly curved, mostly oblique. Monad with green chromatophores, prominent pigment spot and robust flagellum Observed dimensions: lorica 28 μ diameter, aperture tube 6–16 μ long, 5 μ wide, caudal spine 14 μ long

Trachelomonas praeliaris var nana var. nov Plate I, figure 10

Lorica colorless, spheroidal, surface nearly smooth, adhesive. Diameter of lorica 12 μ. Aperture a short, wide tube, lip not everted Caudal process short and often blunt.

Pond water Chadd's Ford, Pa August, 1923

These forms were collected on three different days from ponds in the Brandywine meadows This is historic ground, and I commemorate in the species name, the Battle of the Brandywine

The lorica of the species, and even of the variety, though very thin-walled, withstands perfectly both drying and ignition on the coverglass When all the organic matter has been burned away, it has merely darkened a little without much change toward red-brown Previous to ignition the sticky surface is apt to bear a few extraneous particles, and if these happen to be grains of sand, they remain attached when ignition is completed Indication of this is to be seen in the accompanying figures

This remarkable form would seem to have a number of allies in various regions The Siamese *T schauinslandii* Lemm , (5) has remote resemblance, but a direct comparison of the single specimen found in the Brandywine gatherings showed it to be altogether another thing The Javan *T affinis* Lemm , var *planktonica* Woloszynska, and *T treubi* Woloszynska (13), and the Russian *T longicaudata* Swirenko (12) belong also to the wide-apertured section of the genus The last named, to judge by figure and description nearest of all, differs notably in size, shape and structure of the caudal spine *T treubi* is given as oval in cross section, and *T affinis* is said to be a close ally of *T acuminata* Stein The Brandywine form is none of these things Lastly, the magnificent *T. ensifer* Daday (4) of Paraguay, similar in outline, has no other resemblances, and appears to be unique in the genus with respect to the structure of the aperture

As to the variety, I give it a name, though it may be only a stage in the life cycle of the species In Plate I, fig 9, is indicated an occasional condition, in which the aperture tube, at first finished at a moderate length, has later grown considerably longer

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Explanation of Plate I

Figure 1 —Trachelomonas nexilis sp. nov 1000/1
2 —Trachelomonas columba sp nov 1000/1
3 —Trachelomonas flava sp nov 1000/1
3a -Trachelomonas flava Diagram of aperture
4 —Trachelomonas depressa sp nov 1000/1
4a -Trachelomonas depressa Diagram of aperture
5.—Trachelomonas boyeri sp nov 2000/1.
6 —Trachelomonas terminus sp nov 2000/1
7 —Trachelomonas triquetra Playfair var jaculata var nov. 1000/1
8 —Trachelomonas praeliaris sp nov 1000/1
9 —Trachelomonas praeliaris sp nov. 1000/1 Showing supplementary growth of aperture tube
10 —Trachelomonas præliaris var nana, var nov 1000/1

Note —In the cases of *T boyeri* and *T terminus* it was found impossible to draw useful figures on the scale of 1000/1 owing to the minuteness of the loricae and of all their features Studies for all these figures included observations with a Leitz 2 mm objective of 1 32 N A. and ocular × 10 The preparations were mostly made with Canada Balsam, but in every case the organisms had been observed to some extent while alive

THE SPECIES OF BASILIOCHITON

BY S STILLMAN BERRY

Since the publication of my previous notes (11, 17) on the group of species of which *Trachydermon flectens* Carpenter is the earliest described member, not very much more material has come to hand That little, however, has thrown additional light on several moot questions One of the new specimens is patently representative of a curious new species evincing evident relationship with the *flectens* group, but with certain unique characters which preclude its reference to the typical group and may eventually demand removal to a separate genus

Another specimen, generously sent to me by Mr M J Becker, of Pacific Grove, appears upon disarticulation to be probably the true *Mopalia heathii* Pilsbry the identification having been accomplished with reasonable certainty by comparison with a series of figures of the type specimen which I have been able to secure through the courtesy of Dr Pilsbry himself As the species seems never to have been figured, the illustrations in question are published herewith

In view of our apparent inability to use Carpenter's name *Trachydermon* for this group, *Basiliochiton* was proposed as a substitute by the present writer in 1918, with *Mopalia heathii* Pilsbry as type A key to the three forms now considered referable to this genus follows

KEY TO THE SPECIES OF BASILIOCHITON

1 Shell high arched, elongate, smooth, the color light brownish, girdle setae coarsely spinose sinus very spongy *lobium*
1′ Shell only moderately elevated, oblong, upper surface evenly granulate, the color olive green, or red with blue spots girdle setae with long, slender, branch-like spines, sinus not distinctly spongy *Basiliochiton* (s s) 2
2 Adults always small (9–12 mm), anterior valve and lateral areas not ribbed *flectens*
2′ Adults attaining fair dimensions (25 mm), anterior valve and lateral areas with obscure radial ribs *heathii*

Basiliochiton flectens (Carpenter 1864)

1864 *Trachydermon flectens* Carpenter Rep Brit Assn Adv Sci 1863 p 649 [135]

1892 *Ischnochiton (Trachydermon) flectens* Pilsbry, Man Conch, (1), vol 14, p 75
1893 *Trachydermon flectens* Pilsbry, Man Conch, (1), vol 15, p. 64, pl 15, fig 34-37
?1898 *Mopalia Heathii* Pilsbry (pars), Proc Ac Nat Sci Phila., 1898, p 288
1911 *Mopalia (Dendrochiton) heathii* Berry (except synonymy), Proc Ac Nat Sci Phila, 1911, p 490, text fig 4-7, pl 40, fig 1-3, 7
1917 *Trachydermon flectens* Berry, Proc Cal Ac Sci, (4), vol 7, p 230 232, 239, 245-248
1918 *Lepidochitona flectens* Dall, Nautilus, vol 32, p 3
1918 *Basiliochiton flectens* Berry, Nautilus, vol 32, p 12

TYPE LOCALITY Puget Sound, Washington (Carpenter)

RECORDED RANGE 15-30 fathoms, off Forrester Island, Alaska (!), to San Diego, California (Cooper).

REMARKS It now becomes evident that my suspicion that the small *Basiliochiton* which occurs off Monterey at a depth of 12 to 15 fathoms, and which was described by me in 1911 under the mistaken conviction that it was *heathii*, is only a form of Carpenter's *flectens* is fully justified, although, as already noted, *flectens* and the true *heathii* have very near affinity with one another

Dry specimens of *flectens* from Forrester Island, Alaska, collected by Mr George Willett [S S B 216] run somewhat larger than the southern ones and are generally a Morocco Red in color, sometimes more or less mottled, particularly on valve vi, with a lighter tint fairly near Spinel Red. Dry specimens of my own collecting from 12 fathoms, off Monterey, California [S S B 1199] are more of a Dragon's Blood Red over valves iii-vi, the other valves a Garnet Brown The interior of these shells is Spinel Red, toning lighter near the margin

It may some day be suggested that *flectens* is only the young of *heathii* Wherever it has been found the uniformity in the size of the largest specimens, and the fact that they bear every appearance of maturity, militates against this view. Unfortunately no undoubted juvenals of *heathii* have yet come to hand for direct comparison.

Basiliochiton heathii (Pilsbry 1898) Plate II, figures 3-5

1898 *Mopalia Heathii* Pilsbry, Proc Ac Nat Sci Phila., 1898, p 288
1904 *Mopalia heathii* Keep, W Am Shells, p 350 (merely catalogued)
1910 *Mopalia heathii* Thiele, Rev Syst Chit, II, p 108, 109
1911 *Mopalia (Dendrochiton) heathii* Berry (synonymy only), Proc. Ac Nat Sci Phila, 1911, p 490
1917 *Trachydermon heathii* Berry, Proc Cal Ac Sci, (4), vol 7, p 245-248
1918 *Basiliochiton heathii* Berry, Nautilus, vol 32, p 12

Type: Cat No 71,902, Academy of Natural Sciences of Philadelphia

Type Locality: Pacific Grove,, California (Pilsbry)

Recorded Range Pacific Grove (!) to Carmel (!), Monterey County, California

Remarks I have been enabled for the first time to establish with some degree of assurance the identity of this beautiful but little known species by a specimen [S S B 1172] taken between tides at Pacific Grove, California, by Mr M J Becker This example, generously donated for the purpose by Mr Becker, has been disarticulated and proves to be in fairly complete accord with all the more essential points of Dr Pilsbry's original description, as well as with the beautiful series of figures of the type sent me from the Philadelphia Academy and here made of record (Plate I, figs 3-5, text figs 1, 2) It is surprising how very similar this species is to *B. flectens* in nearly every way except size, color, and its very much flatter outline But further material will be needed before a complete comparison can be instituted From present

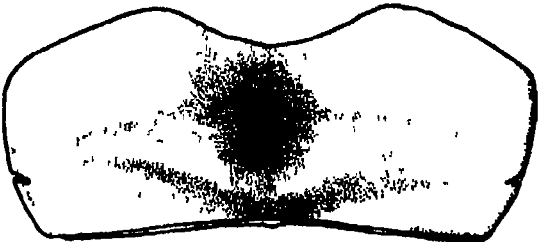

Fig 1

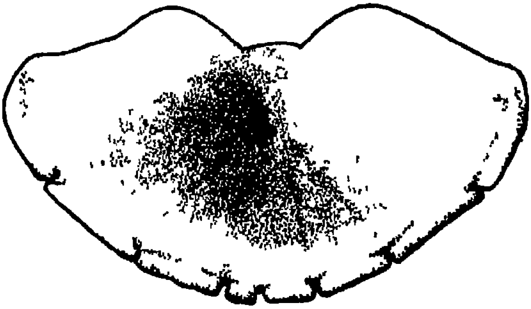

Fig 2

indications I take it that the shell is somewhat thicker than that of *flectens*, both relatively and absolutely, the head valve is shorter the granular sculpturing stronger and closer, and the insertion teeth considerably shorter in proportion to their width, all making toward a certain aspect of individuality, so that if all shells prove essentially similar to those studied, there should be no difficulty in separating them into their respective species The possibility that *flectens* may be merely an immature stage of the larger form has already been suggested on an earlier page In fact, I now suspect more than ever that both species were before Dr. Pilsbry when his description of *heathii* was written, especially since at that time *flectens* was a poorly-known species, and its possession of mopalioid sutural setae an entirely unsuspected fact The largest *flectens* so far discovered, such as those from Forrester Island, [216], are reasonably uniform, not exceeding 12 mm in length, while those dredged in Monterey Bay run smaller than that

The present specimen of *B. heathii* has the ground color of the shell a deep brownish red very close to Bay of Ridgway, with some valves, especially valve vi and the sides of valve vii, more or less mottled with pinkish buff The interior of the shell is Hellebore Red, toned with Deep Hellebore Red and Vernonia Purple

All the girdle setae are unfortunately badly broken, but there are traces of a major seta at each suture, four in front of the head valve, and two behind the tail valve, as in *flectens*[1]

LOPHOCHITON new subgenus.

Chiton of small size, with unsculptured shell showing little or no differentiation into distinct areas; tail valve entire, insertion plates apparently normal, the slit formula probably 8, 1–1, 9, sinus spongy, girdle rather narrow, covered dorsally with minute granular scales, conspicuous marginal spinelets, and a series of

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[1] After these notes were put into Ms , a short visit to the Academy of Natural Sciences at Philadelphia unexpectedly afforded me opportunity for a somewhat hasty examination of the original material of this species The type lot (A N. S P No 71902) contains three specimens.

The largest specimen, which may be taken as the type, is relatively elongate and the lateral areas and terminal valves are more distinctly ribbed than I had anticipated from either the published description or the figures The sculpture is fairly coarse

A smaller specimen has relatively coarser and sharper pustulation, but the ribbing is less evident

A still smaller example, represented by the valves only, was very suggestive of *flectens* and seemed in fact to be that species Unfortunately, I had none of my own specimens with me for the direct comparison which would be so desirable small, strongly spinose sutural tufts or setae which continue around the terminal valves

TYPE. the following species.

Basiliochiton lobium new species Plate II, figures 1-2

DIAGNOSIS· Shell rather small, with a slight luster; elongate-oval, well elevated, the side slopes nearly straight; valves distinctly beaked behind Entire surface unsculptured and nearly smooth except for the numerous very fine lines of growth and traces of an extremely minute granulation barely discernible under even high magnifications Texture of shell somewhat streaky radially

Anterior valve short, crescentic, its slope very steep in front and slightly convex; faint traces of low radial ribs leading to the insertion slits possibly discernible.

Intermediate valves with lateral areas scarcely definable and not raised Posterior valve small, with well elevated median mucro, and an initially sharply falling, then more gradual slope behind.

Articulamentum subtranslucent, porcellaneous, whitish. Sutural laminae thin, rather broadly arcuate, not continuous across the fairly wide, distinctly spongy sinus. Specimen not disarticulated, but anterior valve evidently with about 8, intermediate valves with 1-1, posterior valve with 9 slits, all slits having porous rays leading into them which are especially conspicuous in the head valve

Girdle narrow, rather delicate and inclined to curl in dried material; covered dorsally with very minute granular scales, giving an effect like fine sandpaper, and an abundant, but easily broken, marginal armature of long, dagger-like spinelets, a few similar spinelets noted here and there on the upper surface may be adventitious from the margin; sutural tufts present, consisting of a group of 3-12 somewhat falciform spinules situated on whitish spots a little way out from each suture, 7 rather smaller tufts around the head valve, and 5 similar ones around the tail valve, best preserved tufts indicative that these are remnants of coarsely spinulose, recurved, plume-like setae, bearing spinules on the upper or posterior margin only

Ctenidia extending to valve iii

Color of outer surface of shell Deep Olive Buff, shading to Vinaceous Fawn near the girdle and clouded with Citrine Drab along the ridge; sutural margin of head valve, all of tail valve, and vicinity of a sharply marked "jugal triangle" on valve iii, finely mottled Dark Olive Girdle darker, with conspicuous whitish spots around the setae

MEASUREMENTS· Maximum length of type, 13 2 mm ; maximum width, 6.1 mm., altitude, 2 8 mm.; length of shell only, 13.0 mm , width of tegmentum of valve iv, 5.1 mm , of valve v, 5.2 mm

Type A shell preserved dry [S S B 1353] entered as Cat No 4908 of the author's collection

Type Locality Tide pool in the "Devil's Slide," La Jolla, California, Allyn G. Smith, Feb. 9, 1919, 1 specimen

Remarks. The only specimen seen of this inconspicuous, but very peculiar little chiton was unfortunately not preserved in alcohol, so the detailed structure of the setae is not easy to make out Furthermore every valve but the tail plate had been broken squarely across on the left side, and the head valve in another place likewise, so that it has seemed unwise to try to disarticulate the shell However, the form and surface characters of the shell itself are well shown, and seem quite sufficient to afford a workable characterization of the species, at any rate so far as its mere future identification is concerned. Its exact relationships are perhaps a little more obscure, although the persisting remnants of the girdle armature incline me to place it in *Basiliochiton* The combination of mopalioid girdle and entire tail valve preclude reference of this species to any of the other named genera of this family except *Dendrochiton*, but all the species in this latter group exhibit a very different type of surface sculpture

B lobium differs conspicuously from both *B heathii* (Pilsbry) and *B flectens* (Carpenter) in its dull, tawny rather than ruddy, coloration, narrowed outline, greater elevation, sharper dorsal angle, lack of granulation, more spongy sinus, and more coarsely spinose setae None of our described chitons seems really very much like it, and so it has seemed worth while to propose a new subgenus for it, even though some students may prefer for the present to treat the group as of merely sectional rank

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EXPLANATION OF PLATE II

Fig 1 *Basiliochiton lobium* Berry Right side of valves iv–vi and adjacent region of girdle of type specimen, dorsal aspect × 18

From microphotographs by John Howard Paine

Fig 2 *Basiliochiton lobium* Berry Dorsal view of type specimen [1353], from La Jolla, California, × 7½

Fig 3 *Basiliochiton heathii* (Pilsbry) Dorsal view of head valve of type specimen, from Pacific Grove, California, considerably magnified

Fig 4 *Basiliochiton heathii* (Pilsbry) Dorsal view of valve vii of type specimen, same scale

Fig 5 *Basiliochiton heathii* (Pilsbry) Dorsal view of tail valve of type specimen, same scale

From drawings by Helen Winchester

EXPLANATION OF TEXT FIGURES.

Fig 1 *Basiliochiton heathii* (Pilsbry) Interior of valve vii of type specimen, from Pacific Grove, California Drawn by Helen Winchester

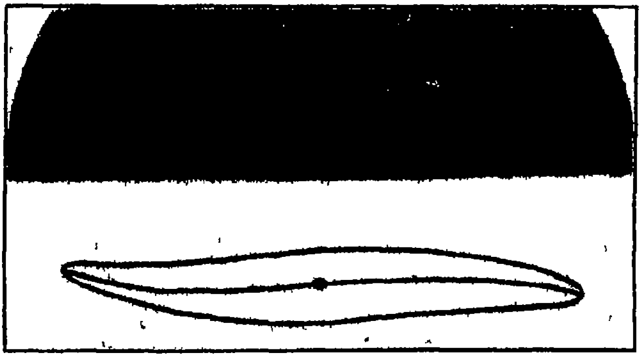
Fig 2 *Basiliochiton heathii* (Pilsbry) Interior of tail valve of type specimen Drawn by Helen Winchester

PLEUROSIGMA BOYERI: A NEW DIATOM FROM FLORIDA.

BY F. J. KEELEY

De Leon Spring, near De Land, Florida, reputed to have been discovered by Ponce de Leon in 1512, is one of the several large springs for which the State is noted. It has a constant flow, according to most conservative estimate of engineers, of 38,000 gallons per minute, with sufficient fall from the pool to the river of which it is the source, to supply water power which formerly operated a sugar mill, the ruins of which still exist.

De Leon Spring is rich in diatoms, the aquatic vegetation of the pool, and particularly just below the overflows therefrom, being generally covered with a visible film of these organisms. The predominant form is *Biddulphia laevis*, which has not been absent from any of numerous gatherings made during past ten years. It may be collected practically pure, or at other times in but small proportions mixed with various fresh-water species of *Navicula*, *Synedra*, *Surirella*, *Gomphonema*, etc. In the spring of 1923, the partly-shaded race below the old mill had its bottom and sides, and every stick and stone, covered with a dark chocolate-brown layer, five to ten millimeters thick, consisting of *B. laevis*, many of the filaments terminated by large sporangial frustules, mixed with *Terpsinoe musica*; while a year earlier, plants below one of the spillways were encrusted with a similar but lighter brown coating



made up largely of *Nitzschia paradoxa* and *Navicula confervacea*, with a considerable admixture of *Achnanthes subsessilis* The latter is generally regarded as marine, but there seems to be a number of diatoms equally at home in fresh or salt water. For instance, the *Nitzschia paradoxa*, growing so luxuriantly at De Leon Spring, was found equally plentiful in a gathering from a wharf piling on the North Indian River, where it is as salt as the ocean *Terpsinoe musica*, while almost invariably found in fresh water, also occurs in the Indian River.

In spite of the large quantity of diatoms found there, De Leon Spring had proved disappointing with respect to unusual forms until last year, when I noted on one of the foundation stones of the old mill, over which a small trickle of water leaked from the race, some thin brown patches which were carefully collected and on examination proved to consist entirely of small *Pleurosigma*, including some *P.* (*Gyrosigma*) *spencerii*, but mostly a form, which after careful study and comparison, seems entitled to be regarded as a new species It somewhat resembles *P. pusillum*, which can be found on Hamilton L. Smith's slide No. 539, but is longer and narrower, with finer and more obliquely arranged markings, for a photograph of which, under a magnification of 1500 diameters, I am indebted to the skill of Dr Thomas S Stewart. I take pleasure in dedicating this species to my friend Mr. Charles S. Boyer, the noted diatomist of Philadelphia.

Pleurosigma boyeri n sp Text figure

Valve lanceolate, moderately sigmoid, with raphe more flexed than margin Length, 86 to 97 microns, usually 90 to 95

Width, 11 microns

Markings of oblique rows, 30 to 32 in 10 microns, intersecting at an angle of 52 to 54 degrees. Transverse rows 24 to 26 in 10 microns

Fresh water, De Leon Spring, Florida.

THE ORTHOPTERA OF SOUTH DAKOTA

BY MORGAN HEBARD

Through the untiring effort of Professor H C Severin, one of the most complete series of Orthoptera ever assembled in a central western state has been secured in South Dakota This material was originally put in our hands for determination, and as the series increased it was decided that a list should be published Finally we found so large a percentage of the native forms that a detailed study was seen to be fully justified and the present paper has resulted

It is here not our purpose to enter into the systematics further than to publish such synonymy as has been found, and describe a single new subspecies, *Melanoplus bowditchi canus*, on page 120. As an aid to the student we have given the original reference to each species and the reference which, in subsequent literature, we believe is most useful in locating it

The listing of the material follows, with data as to the abundance, habits and duration of adult appearance, accompanied by as full an outline of the species or races distribution as can, at the present time, safely be given This latter feature has involved an unexpectedly great amount of work Many of the Great Plains and other western species, some of which we know to be widely distributed and abundant, have been little discussed, and records were constantly appearing which could not be given without verification Such compilation, though an unwelcome task, we hope will prove of value in future studies of western Orthoptera.

We here record one hundred and forty-nine species and races from South Dakota, of which one hundred and forty-five are native, represented by a series of over eight thousand eight hundred specimens from all portions of the state Twenty-one other species are discussed briefly, which are almost certain to be found eventually in the state. The collection belongs to Professor Severin, with the exception of series retained by the author.

The regions occupied by these species are roughly indicated by the following list:

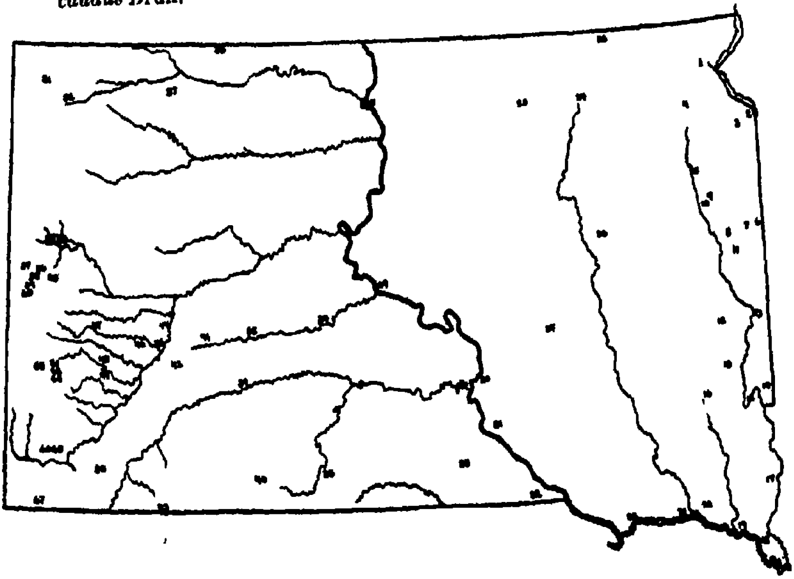
Dermaptera	Page	Distribution
Labia minor (L.)	39	Introduced
Orthoptera		
Blattidae		
Pseudomopinae		
Blattella germanica (L.)	40	Introduced
Parcoblatta pensylvanica (DeG.)	40	Eastern
Parcoblatta virginica (Brunner)	40	Eastern
Panchlorinae		
Panchlora cubensis Sauss.	41	Adventive, tropical
Mantidae		
Litaneutria minor (Sc.)	41	Western
Phasmidae		
Pachymorphinae		
Parabacillus coloradus (Sc.)	42	Western
Heteronemiinae		
Diapheromera femorata (Say)	43	Eastern
Diapheromera velii Walsh	44	Prairies and Great Plains
Acrididae		
Acrydiinae		
Nomotettix cristatus sinuifrons Hanc.	44	Northeastern
Acrydium granulatum Kirby	45	Northern.
Acrydium acadicum acadicum (Sc.)	46	Northern
Acrydium ornatum (Say)	47	Eastern
Acrydium arenosum angustum Hanc.	48	Northeastern.
Paratettix cucullatus (Burm.)	49	Eastern
Tettigidea lateralis parvipennis (Harr.)	49	Eastern and possibly southwestern
Acridinae		
Pseudopomala brachyptera (Sc.)	50	Locally, east and west
Mermiria neomexicana (Thos.)	50	Prairies, Great Plains and southwestern.
Mermiria maculipennis mcclungi Rehn	51	Prairies, Great Plains and northern Utah.
Acrolophitus hirtipes (Say)	52	Great Plains.
Eritettix tricarinatus (Thos.)	52	Prairies and Great Plains.
Opeia obscura (Thos.)	53	Prairies and Great Plains to Utah
Amphitornus coloradus (Thos.)	54	Northwest, Great Plains and Prairies.
Cordillacris occipitalis occipitalis (Thos.)	55	Southern Great Plains
Cordillacris occipitalis cinerea (Bruner)	56	Northern Great Plains.
Cordillacris crenulata (Bruner)	56	Great Plains.
Phlibostroma quadrimaculatum (Thos.)	57	Great Plains and southwestern.
Chloealtis conspersa Harr.	57	Northern.
Chloealtis abdominalis (Thos.)	58	Northern, not east of Ontario
Orphulella pelidna (Burm.)	59	Eastern and southwestern
Orphulella speciosa (Sc.)	59	Eastern, west to Montana.
Dichromorpha viridis (Sc.)	60	Eastern.
Chorthippus curtipennis curtipennis (Harr.)	61	Eastern, west to Montana and New Mexico
Gomphocerus clavatus Thos.	62	Great Plains and Rocky Mountains.
Platybothrus brunneus (Thos.)	63	Northwestern
Stethophyma gracile (Sc.)	64	Northern.

Acridinae	Page	Distribution
Stethophyma platyptera (Sc.)	65	Eastern, local.
Stirapleura delicatula (Sc.)	65	Northwestern.
Psoloessa texana Sc.	66	Southwestern
Ageneotettix deorum Sc.	66	Prairies and Great Plains.
Aulocara elliotti (Thos.)	67	Western
Aulocara femoratum Sc.	68	Western, more southern than *elliotti*
Oedipodinae		
Arphia pseudonietana (Thos.)	68	Northwest and Great Plains, east to Michigan
Arphia frigida Sc.	69	Northwestern
Arphia xanthoptera (Burm.)	70	Eastern
Arphia simplex Sc.	71	Central southern and Mexico
Chortophaga viridifasciata (DeG.)	72	Eastern, west to Utah.
Encoptolophus subgracilis Caud.	73	Central southern and southwestern
Encoptolophus costalis (Sc.)	73	Great Plains
Encoptolophus sordidus (Burm.)	75	Eastern
Camnula pellucida (Sc.)	75	Northern and far western.
Pardalophora apiculata (Harr.)	76	Northern
Pardalophora haldemanii (Sc.)	77	Central prairies only
Xanthippus montanus (Thos.)	78	Great Plains to Arizona, local
Xanthippus corallipes latefasciatus Sc.	78	Northern Great Plains.
Hippiscus rugosus (Sc.)	80	Eastern
Dissosteira carolina (L.)	80	East and west
Dissosteira longipennis (Thos.)	81	Great Plains.
Spharagemon bolli Sc.	81	Eastern, west to Colorado
Spharagemon equale (Say)	82	Great Plains and northwestern
Spharagemon collare (Sc.)	83	United States, except the far west
Derotmema haydeni haydeni (Thos.)	83	Great Plains
Mestobregma kiowa (Thos.)	84	Great Plains and northwestern
Mestobregma plattei plattei (Thos.)	85	Great Plains
Metator pardalinus (Sauss.)	85	Great Plains to Arizona plateau
Trimerotropis gracilis (Thos.)	86	Northwestern
Trimerotropis cincta (Thos.)	87	Rocky Mountains
Trimerotropis bruneri McN.	87	Great Plains
Trimerotropis laticincta Sauss.	88	Great Plains
Trimerotropis campestris McN.	88	Northwestern
Trimerotropis agrestis McN.	90	Great Plains
Trimerotropis salina McN.	90	Prairies and Great Plains, local.
Trimerotropis perplexa Bruner	91	Northern Great Plains.
Hadrotettix trifasciatus (Say)	91	Great Plains and southwestern
Circotettix rabula nigrafasciata Beamer	92	Great Plains
Aerochoreutes carlinianus carlinianus (Thos.)	93	Northern Great Plains and Rocky Mountains.
Batrachotetriginae		
Brachystola magna (Gir.)	94	Great Plains to northern Mexico.
Cyrtacanthacrinae		
Paropomala wyomingensis (Thos.)	94	Great Plains
Schistocerca lineata Sc.	95	Prairies and Great Plains
Hypochlora alba (Dodge)	96	Prairies and Great Plains.
Campylacantha olivacea olivacea (Sc.)	96	Southern Great Plains, east to Georgia.
Aeoloplus turnbulli plagosus (Sc.)	97	Prairies and southern Great Plains.
Aeoloplus turnbulli turnbulli (Thos.)	97	Northern Great Plains
Hesperotettix viridis (Thos.)	98	Great Plains to southern New Mexico.

Cyrtacanthacrinae	Page	Distribution
Hesperotettix brevipennis pratensis Sc	98	Eastern (except Atlantic Coast), to Rockies
Hesperotettix speciosus (Sc.)	99	Prairies and Great Plains
Melanoplus scudderi scudderi (Uhl.)	99	Eastern
Melanoplus discolor (Sc.)	100	Southern Prairies and Great Plains.
Melanoplus dodgei huroni Bl	100	Northern, not east of Michigan
Melanoplus differentialis (Thos.)	101	Western, reaching east to Indiana, Kentucky and Tennessee and locally present in Pennsylvania, New York and New Jersey
Melanoplus bivittatus (Say)	102	Northern
Melanoplus dawsoni (Sc.)	103	Northwestern, but found locally east to Maine and Pennsylvania
Melanoplus gladstoni Sc.	104	Northern Great Plains
Melanoplus confusus Sc.	105	East and west, south to Arizona.
Melanoplus femur-rubrum femur-rubrum (DeG.)	106	East and west
Melanopus infantilis Sc	107	Northwestern
Melanoplus kennicottii Sc	108	Northwest to Alaska
Melanoplus lakinus (Sc.)	108	Great Plains and southwestern.
Melanoplus occidentalis occidentalis (Thos.)	109	Western
Melanoplus fasciatus (F. Walker)	110	Northern
Melanoplus borealis junius (Dodge)	111	Northern, but south of typical *borealis*.
Melanoplus mexicanus atlanis (Riley)	112	East and west
Melanoplus spretus (Walsh)	113	Central western
Melanoplus bruneri Sc	114	Northwestern, east to Michigan
Melanoplus keeleri luridus (Dodge)	115	Northeastern, west to Wyoming and Colorado
Melanoplus packardi Sc	115	Prairies, Great Plains and northwestern
Melanoplus fluviatilis Bruner	116	Rivers of Great Plains
Melanoplus angustipennis (Dodge)	117	Prairies and Great Plains, east to Ontario and Indiana
Melanoplus flavidus flavidus Sc	118	Prairies and Great Plains
Melanoplus bowditchi canus new subsp	120	Northern Great Plains
Phoetaliotes nebrascensis (Thos.)	123	Prairies, Great Plains and northwestern, east to Indiana
Dactylotum pictum (Thos.)	124	Southern Great Plains
Tettigoniidae		
Phaneropterinae		
Phaneroptera pistillata (Brunner)	125	Northeastern
Phaneroptera curvicauda curvicauda (DeG.)	126	Eastern, between northern and southern races
Phaneroptera texensis (S. and P.)	126	Eastern.
Phaneroptera furcata furcata (Brunner)	127	Eastern.
Amblycorypha oblongifolia (DeG.)	127	Eastern
Amblycorypha rotundifolia iselyi Caud.	128	Central Prairies only.
Copiphorinae		
Neoconocephalus ensiger (Harr.)	129	Northeastern
Conocephalinae		
Orchelimum vulgare Harr	129	Eastern, west to Wyoming.
Orchelimum gladiator Bruner	130	Northeastern.

Conocephalinae	Page	Distribution
Orchelimum calcaratum R. and H.	130	Central southern
Orchelimum nigripes Sc.	131	Central eastern and southern
Orchelimum concinnum delicatum Bruner	131	Northern Great Plains and eastern Rockies, east to Indiana
Conocephalus fasciatus fasciatus (DeG.)	134	Eastern, west to Rocky Mountains
Conocephalus brevipennis (Sc.)	134	Eastern
Conocephalus nemoralis (Sc.)	135	Eastern
Conocephalus strictus (Sc.)	135	Eastern and southwestern
Conocephalus nigropleurum (Bruner)	136	Central eastern, east to New York.
Conocephalus saltans (Sc.)	136	Eastern, west to Rocky Mountains
Decticinae		
Pediodectes haldemanii (Gir.)	138	Central Great Plains
Pediodectes stevensonii (Thos.)	139	Great Plains
Pediodectes nigromarginata (Caud.)	139	Great Plains
Rhaphidophorinae		
Ceuthophilus maculatus (Harr.)	140	Eastern
Ceuthophilus caecus Sc.	141	Eastern
Ceuthophilus fusiformis Sc.	141	Prairies and Great Plains
Ceuthophilus divergens Sc.	143	Prairies and Great Plains
Daihinia brevipes Hald.	145	Great Plains and adjacent Prairies
Udeopsylla robusta Hald.	145	Great Plains and westward
Tachycines asynamorus Adel.	146	Introduced.
Gryllidae		
Gryllinae		
Gryllus assimilis (Fabr.)	147	East and west
Nemobiinae		
Nemobius faciatus fasciatus (DeG.)	147	Northeastern, west to Rockies.
Nemobius fasciatus abortivus Caud.	148	Northern Great Plains
Nemobius carolinus carolinus Sc.	149	Eastern
Nemobius carolinus brevicaudus Bruner	150	Great Plains
Oecanthinae		
Oecanthus nigricornis (F. Walk.)	150	Eastern
Oecanthus niveus (DeG.)	151	East and west
Oecanthus angustipennis Fitch	152	Eastern
Oecanthus latipennis Riley	152	Eastern
Trigonidiinae		
Anaxipha exigua (Say)	153	Eastern, to Brownsville, Texas
Tridactylinae		
Ellipes minuta (Sc.)	155	All but northern United States

Over half these species are western, of which the majority are characteristic types of the Great Plains fauna. Of the balance, eleven occur in the northwest, six are generally distributed over the west, one is largely confined to the Rocky Mountains and one occurs in the southwest. It is becoming increasingly evident, however, that many of the forms, best known from the Great Plains, have a wide distribution over the high plains of the southwestern United States and northern Mexico. Twenty-two of the species here considered are found from the Atlantic to the Pacific, half being boreal forms. Two species only are peculiar to the prairies in the latitude of South Dakota[1] and five reach this state from the south. The remaining thirty-nine eastern forms occur only in extreme eastern South Dakota, a number of them being confined to the southeastern corner. The most interesting extensions of known distribution are shown by *Arphia simplex* Sc., *Encoptolophus subgracilis* Caud., *Trimerotropis gracilis* (Thos.), *Melanoplus discolor* (Sc.), *Melanoplus kennicottii* Sc., *Orchelimum calcaratum* R. and H., *Ceuthophilus caecus* Sc. and *Nemobius carolinus brevicaudus* Brun.



Aberdeen	24
Ardmore	67
Battle Mountain	65
Big Stone	2
Bijou Hills	31
Bison	37
Brookings	11
Bruce	8
Buffalo	51
Canton	17
Cape	34
Caputa	46
Castle Rock	52
Chamberlain	30
Colton	13
Creston	45
Custer	64
Deadwood	58
Elk Point	18
Englewood	60
Fairfax	32
Garretson	14
Hecla	23
Hermosa	48
Hot Springs	66
Interior	39
Ipswich	25
Lake Albert	10
Lake Hendricks	6
Lake Oakwood	5
Lake Poinsett	9
Lake Preston	26
Lead	59
Lemmon	36
Martin	40
Milbank	3
Mobridge	28
Newell	53
Nisland	54
Philip	38
Pierre	29
Pine Ridge	43
Quinn	41
Rapid City	47
Rosebud	35
Salem	16
Scenic	42
Sioux Falls	15
Sisseton	1
Smithwick	50
Spearfish	57
Springfield	22
State Game Lodge	61
State Game Park	62
Sturgis	55
Sylvan Lake	63
Vermillion	19
Volin	20
Wasta	44
Watertown	5
Waubay	4
Wentworth	12
Wessington Springs	27
White	7
Whitewood	56
Winner	33
Yankton	21

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[1] *Pardalophora haldemanii* (Sc.) and *Amblytropidia rotundifolia iselyi* Caud.

In reference to the literature, Morse's "Orthoptera of New England"[2] is a masterpiece and sufficient in itself for locating all of the species there treated. Blatchley's "Orthoptera of North-Eastern America"[3] covers a much greater number of forms, with an important bibliography, glossary and synonymic index Unfortunately twenty-one species, which we have every reason to believe are valid, are there treated as forms or races, and throughout the significance of the geographic race, as at present understood by biologists, is plainly disregarded This most serious defect, and other errors in generic and specific treatment, mar a work which would otherwise be almost ideal for the student of eastern Orthoptera In regard to the western species the literature is scattered and almost all of the larger publications obsolete The student is therefore advised that recourse to the supplementary references here given, will serve best to lead to the most adequate published discussion of each of these forms

The position of the localities at which material was secured is shown on the accompanying map of South Dakota

DERMAPTERA

FORFICULIDAE

LABIINAE

Labia minor (Linnaeus)

1758 *F[orficula] minor* Linnaeus, Syst Nat , Ed X, I, p 423 [Europe]
1920 *Labia minor* Morse, Proc Boston Soc Nat Hist , XXXV, p 292

Established synonyms are *livida* Gmelin and *minuta* Scudder.

One male of this species, labelled "South Dakota," is before us The insect was probably introduced into the United States from Europe, and material is at hand including localities from the Atlantic to the Pacific oceans

It appears adult late in the spring and is probably most abundant during the summer and early autumn

The insect is usually encountered in manure piles or under boards or other refuse about stables It is occasionally attracted to lights at night, as it is a vigorous flier, though seldom seen on the wing during the hours of bright sunlight.

Though abundant in the east, records from west of the Mississippi river are as yet few and very widely scattered

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[2] Proc. Boston Soc. Nat Hist , XXXV, pp 197 to 556, (1920)

[3] Pp 1 to 784, (1920) Published by the Nature Publishing Co , Indianapolis, Indiana

ORTHOPTERA

BLATTIDAE

PSEUDOMOPINAE

Blattella germanica (Linnaeus)

1767 *B[latta] germanica* Linnaeus, Syst Nat, Ed XII, I, p 638 [Denmark]
1917 *Blattella germanica* Hebard, Mem Amer Ent Soc, No 2, p 57

Established synonyms are *Blatta obliquata* Daldorff and *Ischnoptera bivittata* Thomas

Two specimens from Brookings, in extreme eastern South Dakota, have been examined The species, like the preceding, has probably been introduced from Europe and has been found from coast to coast

It is a domiciliary pest and appears indoors in the adult condition at any time during the year It is more abundantly and generally distributed in the central portions of the United States than in the more northern or southern portions

Parcoblatta virginica (Brunner)

1865 *T[emnopteryx] virginica* Brunner, Nouv Syst Blatt, p 86 [♀, Draper's Valley, Virginia]
1917 *Parcoblatta virginica* Hebard, Mem Amer Ent Soc, No 2, p 96

An established synonym is *Ischnoptera borealis* Brunner

Canton, June 16, 1924, 3 ♂, 3 ♀. Springfield, June 21, 1924, 1 ♀

These records are the northwesternmost for the species. It has been reported from Orono, Maine to Lillington, North Carolina on the Atlantic Coast, but in the Appalachians and Piedmont it reaches their southern limit and is known southwestward to Opelika, Alabama. The previously published western limits were St Anthony Park, Minnesota, Lincoln, Nebraska, and Clark County, Kansas

Like the following species, this is a native sylvan insect, appearing adult in the spring and often very abundant in the east, though difficult to secure except by trapping

Parcoblatta pensylvanica (DeGeer)

1773. *Blatta pensylvanica* DeGeer, Mém. l'Hist Nat. Ins, III, p 537, pl 44, fig. 4 [♂, Pennsylvania.]
1917. *Parcoblatta pensylvanica* Hebard, Mem. Amer Ent Soc, No 2, p. 139

The very different appearing sexes and confused literature resulted in the following synonyms; Saussure's *Blatta borealis*, *Ischnoptera coulomiana*, *nortoniana* and *translucida*, Saussure and Zehntner's *Ischnoptera inaequalis* and Scudder's *Ectobia flavocincta* and *marginata* We have already given ample proof that *Parcoblatta divisa* (Saussure and Zehntner) is a very distinct species, not a race of *pensylvanica* as Blatchley assumes, without proper consideration of the very different specialization of the median segment and first abdominal tergite in the males

Garretson, June 16, 1924, 1 ♂ Canton, June 16, 1924, 2 ♂. Elk Point, June 19, 1924, 2 ♂ Yankton, June 10 to 20, 1924, 3 ♂, 2 ♀; August 30, 1923, 1 ♀ Springfield, June 21 and August 6, 1924, 3 ♀. Bijou Hills, August 31, 1923, 1 ♀ Capa, June 16 to 27, 1922, 3 ♂, 3 ♀

The above records form part of the known northwestern limits of distribution of the insect It has been reported as common in Iowa, and is known as far west as Valentine, Nebraska, Salina and Clearwater, Kansas, and Byers, Waco and Brownsville, Texas In the east it is widely distributed through the northern portions of the United States as far south as Raleigh, North Carolina, Spartanburg, South Carolina, and Thomasville, Georgia, and is also found in southern Ontario

This is a native sylvan insect, which appears in greatest abundance adult in the late spring and early summer

PANCHLORINAE

Panchlora cubensis Saussure

1862 *P[anchlora] cubensis* Saussure, Rev et Mag de. Zool, (2), XIV, p. 230. [♀, Cuba]
1917. *Panchlora cubensis* Hebard, Mem Amer Ent Soc, No. 2, p 198

A single female is in the collection, taken at Centerville This pale green cockroach is widely distributed in the American tropics, in the United States being native only in the Brownsville region of Texas.

It is very frequently introduced in bananas, and the present record is probably the result of such an importation. The species is unable to live for any length of time indoors and has, in consequence, never become even temporarily established in the many localities outside the tropics to which it has been carried.

MANTIDAE

AMELINAE

Litaneutria minor (Scudder)

1872 *Stagmatoptera minor* Scudder, U S Geol Surv Nebraska, Final Rept., pt. 3, p. 251 [Nebraska City, Nebraska]
1923 *Litaneutria minor* Severin, 14th Ann Rept. State Ent. South Dakota, p 35

Thirty-two individuals are before us from Capa, Interior, Wasta, Newell, State Game Park and Hot Springs, the adults taken between July 13 and September 12

This insect is widely distributed and moderately abundant over the Great Plains, finding its eastern limit of distribution in South Dakota Hubbell's queried records of *Litaneutria skinneri* Rehn, from Amidon and Medora, North Dakota, are unquestionably based on the same species and represent its extreme northeastern limit of distribution Westward and southward the same phylum is found over the plains and semi-desert regions and the condition here discussed may be merely a Great Plains race of the Mexican *Litaneutria ocularis* Saussure Careful revision of the genus, with a wealth of material, will be required to solve this problem, at which time a number of synonyms will probably also be proven

Though *minor* has been supposed to have fully-developed organs of flight in the male sex, all of the material from the Dakotas is brachypterous From comparison with large series before us, we are convinced that such has no specific or racial significance

The species appears adult in early summer and is usually abundant throughout the warm weather of the fall It is found in the treeless regions on the ground, usually where the vegetation is scanty

PHASMIDAE

PACHYMORPHINAE (Clitumninae of authors)

Parabacillus coloradus (Scudder)

1893 *B[acillus] coloradus* Scudder, Psyche, VI, p 372 [Colorado, elevation 5500 feet]

1903 *Parabacillus coloradus* Caudell, Proc U S Nat. Mus, XXXVI, p 866

Chamberlain, Capa and Martin

Eight adults are before us, taken from August 31 to September 3.

Chamberlain is the extreme eastern known limit of distribution of this insect. It is a widely distributed species of the arid and semi-arid regions of the west and has been reported from as far west as California. Though apparently preferring areas at an elevation of a few thousand feet, it has been secured as high as 8600 feet in the Sacramento Mountains of southeastern New Mexico Material of the species is before us from Badger, Nebraska and it is also known from Kimball in that state, though not yet reported from either North Dakota or Kansas.

The insect is best secured by sweeping the grasses and low plants in the drier open country which it inhabits. Though enjoying a very extensive distribution, the species is only occasionally found in large numbers It appears adult in South Dakota in early August

HETERONEMINAE

Diapheromera femorata (Say)

1824 *S[pectrum] femoratum* Say, in Long, Expedit. II, p 207 [♂ Falls of Niagara, [New York], Missouri River]

1920. *Diapheromera femorata* Morse, Proc Boston Soc Nat Hist, XXXV, p 322

In the present synonymy have been placed *Diapheromera sayi* Gray and *Bacteria linearis* Gosse

Canton, August 27, 1923, 1 ♂

The species has also been taken at the Selkirk Settlements on the Red River and Miami, Manitoba, and at Grand Forks, North Dakota; these records defining the known northwestern limits of its range. It is generally distributed and sometimes locally very abundant in the eastern United States, but is apparently not able to invade the Sabalian Zone of the southeast and is rarely found beyond the southern limit of the Canadian Zone northward.

We are practically convinced that *femorata* does not reach westward beyond the eastern limit of the Great Plains and that the New Mexican records by Scudder and Cockerell are based on material of other species of the genus These records have resulted in the statement of subsequent authors that the insect occurs westward to the Rocky Mountains, while Brunner glibly remarked that it is found over all of boreal America!

Records from Nebraska and Kansas must be verified before it can be stated whether they are actually based on material of *femorata* or of the following, superficially similar, species

The insect lives in forest trees and shrubbery, apparently preferring oaks, and at times appears in very large numbers. Due to its slow movement and habit of remaining motionless for considerable periods, close observation is required to locate individuals, even when present in large numbers. This insect, like many other walking-sticks, may be said to be mainly, though not strictly, nocturnal

The species probably does not appear adult in the Dakotas until mid-August and is usually more liable to be seen later in the fall, as toward the end of the season it apparently developes a roving tendency and is then occasionally found climbing on fences, up the sides of houses or over porches.

Diapheromera veliei Walsh

1864 *Diapheromera veliei* Walsh, Proc Ent Soc Phila, III, p. 410. [♂, ♀, north bank of Platte River, Nebraska [4]]
1903 *Diapheromera veliei* Caudell, Proc U S Nat. Mus, XXVI, p. 876.

Lake Hendricks, White, Brookings, Sioux Falls, Canton, Yankton, Chamberlain, Capa and State Game Lodge

This insect has been confused with *Diapheromera femorata* (Say), though it may be readily separated by the less robust form, more slender head, much more uniform coloration with unbanded femora and male cerci which have a sharp spine instead of a blunt tubercle internally proximo-ventrad

Unlike *femorata*, the species lives in weeds and grasses, and particularly in *Andropogon*, as pointed out by Severin.

Its distribution is as yet poorly understood, though we know that it is abundant in South Dakota, Nebraska, Kansas, Oklahoma and central Texas and is moderately numerous from Joplin, Missouri, through western Iowa and far up the Red River of the North in Minnesota Its eastern limits are given by Somes[5] as Spickard and Memphis, Missouri, Elmira, Central City, Humboldt and Fertile, Iowa, and Staples, Minnesota Its western limits can not yet be accurately defined, though it is known from Holly and Julesburg, Colorado In a number of cases material has been recorded as *femorata*, while eastward even greater confusion with *Manomera blatchleyi* Caudell has occurred.

The species appears adult early in August and is usually abundant in the open and rather dry grassland environment which it prefers

ACRIDIDAE

ACRYDIINAE

Nomotettix cristatus sinuifrons Hancock.

1899 *Nomotettix sinuifrons* Hancock, Ent News, X, p 278 [♂, ♀, St Anthony Park, Minnesota]
1916 *Nomotettix cristatus borealis* Rehn and Hebard, Proc. Acad Nat. Sci. Phila., 1916, p. 129

Blatchley correctly placed *borealis* as a synonym of *sinuifrons* in 1920.

Brookings, April 17, 1919, 1 juv. ♀. Custer, August, 1892, 1 ♀. Besides these specimens, this race is known only from St Anthony

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[4] The Illinois female represents *Manomera blatchleyi* Caudell. See Ent. News, XXIX, p 258, (1918)

[5] Ent News, XXVII, p 270, (1916)

Park, Minnesota, Diamond Lake in the Temagami District and Gull Lake in the Muskoka District, Ontario[6]

Northernmost of the races of the species, this insect probably prefers the same general type of habitat as typical *cristatus*, rather poor soil with scant vegetation, usually in or near open forests It appears adult quite early in the spring, which, with its small size, obscure coloration and usually very local distribution, probably partly explains the reason why it has as yet been reported from so ew localities, though having an extensive range east and west It is, however, probably one of the rarest races of the species

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We have material of the related *Nomotettix parvus* Morse from the type locality, St Anthony Park, Minnesota, and Douglas County, Kansas[7] That insect will very possibly be found in southeastern South Dakota Though not yet stated, the environment n which this insect occurs is probably less boreal but otherwise very similar to that preferred by *sinuifrons*

Acrydium granulatum Kirby

1837 *Acrydium granulatum* Kirby, Fauna Boreali-Amer, IV, p 251 [Lat. 65', British America]

1920. *Acrydium granulatum granulatum* Morse, Proc Boston Soc Nat Hist, XXXV, p 530

Hancock's *Tettix luggeri*, *morsei* and *granulatus variegatus* are synonyms

Waubay, Lake Hendricks, Lake Oakwood, Brookings, Lake Preston, Elk Point, Newell, State Game Lodge and State Game Park

The fifty-one specimens before us were found adult between April 1st and September 12th This is essentially a spring species, but probably remains abundant in favorable areas until midsummer.

The insect is found on sandy soil both in bogs and marshes, in orested country and sometimes in open fields Its distribution in

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[6] A record from Lakehurst, New Jersey, applies to a specimen of the race *Nomotettix cristatus cristatus* (Scudder)

[7] The unique female type of *Nomotettix acuminatus* Hancock, in the author's ollection, is almost certainly representative of Morse's *parvus* Unfortunately he topotypic specimens of that species in the same collection are males, and we believe that comparison of additional material of both sexes is needed before his synonymy can be unequivocally established

Additional material may also show that *parvus* is a western race of *cristatus*, meeting but showing no intergradation with the northern race *sinuifrons* in he vicinity of St. Anthony Park, Minnesota Should this prove true, it would e evident that these phyla had reached that region by widely diverse routes

South Dakota probably does not include the Great Plains environment

This boreal insect is found from coast to coast, extending its distribution southward in the longitude of South Dakota as far as Holt County, Nebraska. We have examined material from as far north as Dawson, Yukon

Acrydium acadicum (Scudder)

1875. *Tettigidea acadica* Scudder, Dawson Rept Geol. 49 Parallel, p 345 [♀, near Lake of the Woods, Canada]
1899 *Tettix hancocki* Morse, Jour. New York Ent. Soc, VII, p. 200 [♂, ♀, Ames, Iowa.]
1920. *Acrydium ornatum hancocki* Blatchley, Orth of North-Eastern America, p 167

Comparison of large series before us, including paratypes from Ames, Iowa, type locality of *hancocki* and a specimen from St. Anthony Park, Minnesota, compared with the type of *acadicum* by Hancock, study of the literature and recognition of the moderate variation shown by the material, convinces us that the above synonymy should be indicated

Constant confusion has occurred, larger individuals of *Acrydium ornatum* Say having frequently been recorded as *acadicum* or *hancocki* [8]

In the West, material of *acadicum* and *ornatum* is easily separated, the former being decidedly larger and more robust, with fastigium more projecting and pronotal crest somewhat more prominent In the East, however, the differences are sometimes less conspicuous As *acadicum* is often found in company with *ornatum*, it can not represent a geographic race of that species, as has been indicated by Blatchley, being a distinct species as we believe, or a synonym, based on a mere phase The constancy of its differentiation will require very careful analysis of very large series, with a view to discovering also other possibly useful features of difference, and such revision must be accomplished before the absolute validity of *acadicum* can be affirmed. Until this is done a considerable number of synonymic names can not be finally placed

Brookings, Elk Point, Canton, Yankton, Capa, Pine Ridge, Bison, Rapid City, Buffalo, Newell, Spearfish, Whitewood, Deadwood,

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[8] Lugger's figure of *acadicum* is clearly from a specimen of *ornatum*. The author recorded two males of *acadicum* as *A. granulatum* approaching *luggeri*, from Baraga County, Michigan (at Pequaming) and the material then recorded as *acadicum* from a pebbly bar on Ravine River actually represents *A. arenosum angustum* (Hancock)

Englewood, State Game Lodge at 4000 feet, State Game Park and Hot Springs

The present series of one hundred and forty-one individuals was secured from May 8 to September 27 Though the species appears early in the season, it is seen to survive well into the fall in South Dakota, as a number of captures in August and September indicate.

This species occurs eastward to the Atlantic coast, there being found from Ontario and Maine to North Carolina in the Appalachian Mountains and Clarksville, Tennessee. The westernmost of the South Dakotan localities probably represent its limit of distribution in this longitude except in the eastern foothills of the Rocky Mountains, where it is known from as far south as LaPorte, Colorado, and the individuals from Manitou recorded by Rehn and Hebard as *A brunneri* Bolivar show different degrees of convergence toward typical *acadicum* Other Coloradan series further indicate that two races rather than two species occur, the one *A acadicum acadicum* Scudder of the eastern foothills, the other *A. acadicum brunneri* Bolivar of the high Rockies It would therefore appear that the latter is a more boreal race of the former [9] Other records are Edmonton, Alberta, Lake Upsilon and Turtle Mountains, North Dakota, and Lawrence, Kansas

Found usually on moist soils of sandy character, the present insect is almost always decidedly scarcer and very much more local in distribution than *ornatum*, in the regions in which both of these insects occur

Acrydium ornatum Say

1824. *Acrydium ornatum* Say, Amer Entomology, I, pl 5 [Kaign's Point, [Camden County, New Jersey]]

1920. *Acrydium ornatum* Blatchley, Orth of North-Eastern America, p 165.

Big Stone, Hecla, Lake Albert, Lake Hendricks, Lake Oakwood, Brookings, Salem, Canton, Elk Point, Yankton, Springfield, Fairfax, Rosebud, Philip, Pine Ridge, Newell and Whitewood

The series here recorded, including one hundred and ninety-one adults, was secured between April 1 and September 12 The insect apparently reaches its adult maximum abundance in late spring and is clearly the most numerous grouse-locust in central-eastern South Dakota

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[9] Hubbell's record of *brunneri* from Isle Royale and the Porcupine Mountains, Michigan, may represent *acadicum acadicum*, as Morse previously recorded that insect from the latter locality The same may be true of a record of *brunneri* from Frederickton, New Brunswick

This grasshopper is known from New England and Ontario west to Alberta and Colorado and south and southwestward to North Carolina, Tennessee, Mississippi, Texas and New Mexico. We doubt, however, that it occurs on the Great Plains themselves, being probably carried southward further west by the Rocky Mountains, through Colorado to New Mexico It has also been recorded from Kaslo and Fairview, British Columbia

It has habits similar to those of the preceding species, but is always much more generally distributed

Acrydium arenosum angustum Hancock

1896 *T[ettix] angustus* Hancock, Trans Amer Ent Soc , XXIII, p 238, pl VI, figs 4 and 4a, pl IX, fig 24 [Bloomington and Riverside, Illinois]
1916 *Acrydium arenosum angustum* Rehn and Hebard, Proc Acad Nat Sci. Phila , 1916, p 134

Blatchley's attempt to retain the name *obscurum* for this race, in 1920, is proof of his failure to grasp the significance of a geographic race After detailed comparison of a large series, it had been found by Rehn and Hebard that a northern race of *arenosum* was recognizable, this race including Illinois in its area of distribution As *angustus*, *inflatus*, *obscurus*, *gibbosus*, *fluctuosus* and *decoratus* were all names based on material of the species from northern Illinois, the first of these to be described, *angustus*, alone can be used for the northern race

Canton, Elk Point, Springfield and Capa

This insect is very abundant in extreme southeastern South Dakota, its limit of distribution being carried northwestward by the Missouri River and its tributaries, as is shown by the few specimens from Capa One hundred and forty-nine specimens are here recorded, taken between May 10 and September 8. Appearing adult early in the spring, the majority have probably disappeared by summer, though stragglers survive well into the fall.

The northern limits of this race are Truro, Nova Scotia, De Grassi Point, Ontario, Thousand Island Lake, Michigan; St. Anthony Park, Minnesota, and Capa, South Dakota. Though reaching Clayton, Georgia, in the Appalachian Mountains, it intergrades with the typical race at Raleigh, North Carolina; north of Clarksville, Tennessee, and at Cedar Bluffs, Nebraska Capa, South Dakota, and central Nebraska are its western limits.

Paratettix cucullatus (Burmeister)

1838 *T[etrix] cucullatus* Burmeister, Handb Ent, II, Abth II, pt I, p 658 [♀, South Carolina.]

1920 *Paratettix cucullatus* Morse, Proc Boston Soc Nat Hist, XXXV, p 534.

Lake Oakwood, Canton, Elk Point, Springfield, Creston and Sturgis

The great majority of the present series of eighty-nine specimens was secured in extreme southeastern South Dakota, the insect apparently reappearing in the vicinity of the Black Hills in this state. The material was secured between June 14 and August 10

Sturgis, South Dakota, is the most northwestern known locality for the species, which is encountered along the rivers of Iowa, Nebraska and Kansas and has been found in Colorado on the Arkansas River and near the headwaters of the South Platte River Known in the East from Toronto, Ontario and southern New Hampshire to southern Georgia and western Florida, the western limits of its distribution are probably as yet poorly defined This is aggravated by the fact that, though Blatchley has synonymized *P texanus* Hancock, such action was taken, we believe, with insufficient proof that the southwestern insect could not be separated at least as a geographic race

The species appears adult in the spring, at least over large portions of its range, but reaches its maximum adult abundance in the summer and fall

Tettigidea lateralis parvipennis (Harris)

1841 *Tetrix parvipennis* Harris, Rept Ins. Massachusetts Inj Veget 1st Ed., p 152 [Massachusetts]

1920. *Tettigidea lateralis parvipennis* Morse, Proc. Boston Soc Nat Hist, XXXV, p 535.

Morse's varietal name *pennata* has been properly placed in the present synonymy

Big Stone, August 20, 1924, 1 juv ♀ Brookings, June 12, 1923, 1 ♂ Elk Point, June 16 and September 8, 1924, 2 ♀ Springfield, September 7, 1924, 1 ♂

This species is very abundant and widely distributed in the East, there supplanted in the South by the race *T lateralis lateralis* (Burmeister) Westward it was previously known from Minnesota and eastern Nebraska, so that the present constitute the most northwestern records It may occur in the southwest, but we do not feel assured of the validity of Morse's record from Albuquerque, New Mexico, in Scudder and Cockerell

The insect occurs in the open in a great variety of situations, ranging from marshy tracts to dry uplands. Over most of its range it appears early in the spring, but is found adult in moderate numbers often late in the fall

ACRIDINAE

Pseudopomala brachyptera (Scudder)

1862. *O[pomala] brachyptera* Scudder, Boston Jour Nat Hist., VII, p 454 [♂, Princeton, Massachusetts]

1920 *Pseudopomala brachyptera* Morse, Proc Boston Soc Nat Hist, XXXV, p 428

Synonyms of this species are *Opomala aptera* Scudder and form *reversa* Morse

Elk Point, Ipswich, Mobridge, Capa, Rosebud, Martin, Scenic and Buffalo

The series of sixteen specimens here recorded was secured between July 29 and September 7. The female from Mobridge alone is macropterous, a condition rarely developed in the species

This handsome species has a very local and discontinuous distribution and has been recorded from New England, New York, New Jersey, Pennsylvania, Michigan, Iowa, Nebraska, Minnesota, eastern Wyoming, Utah and British Columbia We have also examined a specimen from Grand Rapids, Wisconsin

In the humid East, it occurs among grasses in areas of poor soil or on waste lands, but in the drier portions of the West, it is found in irrigated tracts or beside streams, among the green grasses, which there can grow only in such situations

Though moderately abundant when found, the local character of its distribution causes the insect to be comparatively scarce. In the East it appears adult in the late spring and early summer, individuals surviving until the fall

A longitudinal carina ventrad on the inner face of the caudal femora is, in males, very finely denticulate in the portion opposite the tegmina and, like in numerous other species of this subfamily, is used for stridulating

Mermiria neomexicana (Thomas)

1870 *O[pomala] neo-mexicana* Thomas, Proc. Acad. Nat. Sci. Phila., 1870, p. 77. [♀, northeastern New Mexico]

1919. *Mermiria neomexicana* Rehn, Proc. Acad. Nat. Sci. Phila., 1919, p. 72.

An established synonym of this species is *Mermiria belfrage* Stål.

Capa and Hot Springs.

A large series from Capa and specimens from Hot Springs are all that have been seen of this trim species in addition to those used in Rehn's detailed study, in which the distribution is given as extending "from the Missouri and Yellowstone Rivers region of eastern Montana and western North Dakota, south to central and western Texas and northern Durango, Mexico, east to north-central Illinois, southwestern Iowa, eastern Oklahoma and central-northern Texas, west to southern Montana, west-central Colorado and southern Arizona "

The species, as Morse states, is "characteristic of the coarse grasses of the drier portions of the prairie plains and . . . *often* locally abundant "

The insect does not appear adult before late summer.

As *Mermiria bivittata* (Serville) has been found northwestward as far as northeastern Nebraska, it may very possibly occur in southeastern South Dakota It is an inhabitant of the rich grasslands of the southeastern United States, occurring adult during the late summer and fall

Mermiria maculipennis mcclungi Rehn

1919. *Mermiria maculipennis mcclungi* Rehn, Proc Acad Nat. Sci Phila , 1919, p. 111, pl VII, figs 15 to 26 [♂, ♀, (type locality) Rosebud, Forsythe County, Montana]

Springfield, August 6, 1924, 1 ♀ Pierre, August 5, 1919, 3 ♂, 1 ♀. Capa, August 1 to September 11, 1919 and 1922, 51 ♂, 63 ♀ Whitewood, August 29, 1924, 1 ♂

This insect, until Rehn's revision, had been regularly mistaken for *M bivittata* (Serville) Rehn defines its range as extending "from the eastern Yellowstone Valley of Montana south typically to southern Nebraska, western Kansas, southern Colorado [and also westward to] northern Utah. The eastern limit of the range is apparently reached in south-central Wisconsin, the central axis of Illinois and southern Missouri "

"Grassy patches and stretches of sparse short grass are frequented by this form, these in a variety of [open] situations. The available series shows that the species occurs adult as early as July 8 and as late as September 14." The northwestern known limit is now Columbus, Montana.[10]

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[10] A male is before us taken September 1, 1924, by N Criddle and belonging to the Canadian National Collection.

This race intergrades southward with *M maculipennis maculipennis* Bruner

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Though Bruner has reported that *Syrbula admirabilis* (Uhler) occurs over the entire state of Nebraska, it has as yet not been secured in South Dakota, where it may prove to be present in the richer grasslands along the southern border of the state.

Acrolophitus hirtipes (Say)

1825 *Gryllus hirtipes* Say Amer Entomology, II, pl 34 [♀, banks of Arkansas River, Colorado]
1903 *Acrolophitus hirtipes* Cooley, Bull 51, Montana Agr Exp Sta, pl VII, fig 4
1904 [*Acrolophitus*] *uniformis* Bruner, Biol Cent.-Amer., Orth, II, p 47 [♀, Sterling, Colorado [11]]
1906 *Acrolophitus hirtipes* Rehn and Hebard, Proc Acad Nat Sci. Phila, 1906, p. 363

Queried as a valid species when originally described, the type before us shows that *uniformis* was based on a feature of mere individual color variation

Newell, July 6 to September 6, 1922 and 1923, 3 ♂, 2 ♀ Whitewood, July 8, 1923, 2 ♂

This, after *Tropidolophus formosus* (Say), is probably the most remarkable species of the Acrididae of the Great Plains It has been recorded from numerous localities in eastern Colorado, Buford and Amidon, North Dakota, middle and western Nebraska; Montana, Wyoming, and New Mexico, as well as the Pecos River in the latter state or Texas, while its northern limits of distribution are Medicine Hat, Saskatchewan and MacLeod, Alberta.

This insect is often found moderately numerous locally in strictly plains environment It flies vigorously, but being somewhat clumsy is easily secured. The material before us indicates that adults probably appear in largest numbers early in August

Eritettix tricarinatus (Thomas)

1873 *St*[*enobothrus*] *tricarinatus* Thomas, Rept U S Geol Surv Terr, V, p 84 [♀, Wyoming]
1914 *Eritettix tricarinatus* Somes, Univ of Minnesota Agr Exp Sta Bull 141, Tech, p 19

There is a decided probability that the Texan *E virgatus* (Scudder) and *E. navicula* (Scudder) from southern Colorado and northern New Mexico are synonyms of the present species Study of material from those regions and Wyoming will be needed to prove this.

Lake Hendricks, Lake Oakwood, White, Brookings, Garretson,

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[11] Here selected as single type, Hebard Collection, Type no. 25

Canton, Tabor, Aberdeen, Springfield, Wessington Springs, Mobridge, Pierre, Capa, Rosebud, Philip, Interior, Martin, Rapid City, Pine Ridge, Smithwick, Whitewood and Hot Springs.

The present series of one hundred and forty-seven specimens shows very decided individual color diversity, sometimes accompanied by striking differences in the strength and contour of the pronotal carinae. The male antennae are decidedly clubbed, those of the females being usually very weakly, but occasionally moderately, clubbed

The adults before us were secured from May 11 to August 24, the majority having been taken in June The insect makes its home in the short grass of the plains

Little can be said as to the definite limits of its distribution as, being a spring species, it has usually disappeared by the time field work for Orthoptera is, as a rule, undertaken North of South Dakota, it has been recorded from Devils Lake, North Dakota, northeastward to Ottertail County, Minnesota, and southeastward it is known from Iowa The insect is probably widely distributed over the Great Plains and dry adjacent regions, being wholly supplanted in the humid East by *E simplex* (Scudder)

Opeia obscura (Thomas)

1872 *Ox[ycoryphus] obscurus* Thomas, Prelim Rept U S Geol Surv Montana and Terr , 5th Rept , p 406 [♀, Fort Fetterman[12], Wyoming]
1898. *Opeia obscura* Lugger, Third Ann. Rept Sent. State Exp Sta Univ Minnesota, 1897, p 118

Big Stone, Lake Hendricks, Lake Oakwood, Brookings, Hecla, Wessington Springs, Chamberlain, Mobridge, Pierre, Capa, Interior, Martin, Buffalo, Lemmon, Bison, Newell, Nisland and Spearfish

The present series includes one hundred and two specimens of this common grasshopper, which is generally distributed over the Great Plains, preferring, as its habitat, areas of short grass, particularly buffalo grass These specimens were taken between August 5 and September 6

Northward it has been reported from Buford, Medora and Amidon, North Dakota, while eastward in Minnesota it has been found at Brown Valley, Fergus Falls and Mankato To the south its distribution eastward is decidedly less extensive, as it does not occur in eastern Nebraska It has once been recorded from west of the Rocky Mountains, at Salt Lake City, Utah.

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[12] As determined from the type, in the United States National Museum

The species appears adult from midsummer to late fall

Amphitornus coloradus (Thomas)

1872 *S[tenobothrus] bicolor* Thomas, Ann Rept U S Geol Surv Terr, V, p 465 [♀, east of [Rocky] Mountains in Colorado and Wyoming.]

1873. *St[enobothrus] coloradus* Thomas, Rept U S Geol Surv Terr, V, p 82 (New name proposed to take the place of the homonym, *Stenobothrus bicolor* Thomas)

1897 *Akentetus unicolor* McNeill, Proc Davenport Acad Nat Sci, VI, p 225, plate III figs 12, 12a and 12b [♂, Colorado].

1899 *Acentetus carinatus* Scudder, Proc Amer Acad Arts and Sci., p 45 [♂, Florissant, Colorado]

1906 *Akentetus unicolor* Rehn and Hebard, Proc Acad Nat Sci Phila, 1906, p 364

The presence or absence of pronotal supplementary carinae is a matter of individual variation in this insect, and *Akentetus* McNeill consequently falls as a synonym of *Amphitornus* McNeill.

It is equally evident, from study of the original descriptions and large series of the species before us, that *Akentetus unicolor* McNeill and *Acentetus carinatus* Scudder are synonyms of *coloradus*.

Mobridge, Pierre, Capa, Interior, Buffalo, Newell, Nisland, Spearfish, Whitewood, Sylvan Lake and Hot Springs

This species enjoys a very wide range in the arid regions of the west, but is replaced in California by *A ornatus* McNeill It is true, as Bruner has stated, that the insect is a characteristic species of the Great Plains, but its distribution extends far beyond those limits, as it is known from as far east as Havana, Illinois, and north to Aweme, Manitoba, Walsh, Alberta, and Penticton, British Columbia South of South Dakota it is known as far east as Barber County, Kansas and central Nebraska, and north to Amidon and Medora, North Dakota. In many regions its distribution is probably discontinuous and, until more detailed studies are made, its definite range can not be accurately given.

Though the species is able to adapt itself to a much wider and more diverse environment than *Opeia obscura* (Thomas), it never appears in as great numbers as that insect.

The adults here recorded were taken from July 14 to September 9, the usual period of adult abundance being from mid-summer to late fall.

Cordillacris occipitalis occipitalis (Thomas)

1873. *St[enobothrus] occipitalis* Thomas, Rept. U S Geol Surv Terr, Hayden, V, p 81 [♂, ♀, Colorado[13], Wyoming, southeastern Idaho]
1909. *Cordillacris occipitalis* Rehn and Hebard, Proc. Acad Nat Sci Phila, 1909, p 138

We have been obliged to examine large unstudied series of the genus, in order to determine the status of *occipitalis* and *cinerea* It appears that the latter is a northern geographic race of the former, typical material of which is before us from Lethbridge, Alberta, Montana, Wyoming, Aweme, Manitoba, and Medora, North Dakota It is also apparent that typical *occipitalis cinerea* occurs in northwestern South Dakota, though in that region the condition developed is probably, as a rule, intermediate.

Typical *occipitalis occipitalis* occurs in Colorado east of the Rocky Mountains, in New Mexico and in Nebraska, swinging up into South Dakota in and east of the Pine Ridge country In the Black Hills and in northern South Dakota an intermediate condition between these races is encountered

Superficially *occipitalis occipitalis* differs from *occipitalis cinerea* in its larger size and more elongate form, the (usual) presence of a pale streak in the proximal half of the area between the discoidal and mediastine veins of the tegmina and (usually) pinker caudal tibiae Revisionary study will probably reveal other features useful in separating these races, which show exactly the same distribution in the Pine Ridge country as do the northern and southern races of *Circotettix rabula* Rehn and Hebard.[14]

Hecla, August 22, 1924, 9 ♂, 7 ♀, intermediate between *occipitalis occipitalis* and *occipitalis cinerea*

Martin, September 3, 1923, 1 ♂, 1 ♀, typical *occipitalis occipitalis*

Rosebud, July. 1904, (L Bruner), 1 ♀, intermediate between *occipitalis occipitalis* and *occipitalis cinerea*

Pine Ridge, September 2, 1924, 2 ♀, typical *occipitalis occipitalis*

Buffalo, August 27, 1924, 6 ♂, 5 ♀, intermediate between *occipitalis occipitalis* and *occipitalis cinerea*, except 1 ♂, 1 ♀ which are typical of *occipitalis cinerea*

Wasta, September 12, 1923, 1 ♀, *occipitalis occipitalis*, showing a marked tendency toward *occipitalis cinerea*

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[13] The single type here selected, a female from Colorado, is in the United States National Museum. It measures as follows length of body 12, length of tegmen 15, length of caudal femur 12 mm. The tegmina show the pale streak usual in this race though but rarely found in the race *C. occipitalis cinerea* (Bruner)

[14] See Rehn, Trans' Amer. Ent Soc, XLVII, p 180, (1921)

Creston, June 28, 1924, 2 ♂, 1 ♀, typical *occipitalis occipitalis*

Battle Mountain, east of Hot Springs, 3750 to 4400 feet, July 21, 1909, (J A G Rehn), 1 ♂, 5 ♀, intermediate between *occipitalis occipitalis* and *occipitalis cinerea.*

Hot Springs, October, 1888, (L Bruner), 1 ♀, *occipitalis occipitalis* showing a tendency toward *occipitalis cinerea*

As is often the case, these series of intermediates are individually variable, the most noteworthy being a pair of the Buffalo series, which, as noted above, are typical of *occipitalis cinerea*

Cordillacris occipitalis cinerea (Bruner)

1889 *Ochrilidia* (?) *cinerea* Bruner, Proc U S Nat Mus, XII, p 52 [♂, ♀ Fort McKinney, Wyoming, Birch Creek, Idaho, Burleigh County, [North] Dakota, northwestern Nebraska[16]]

See under *occipitalis occipitalis*

The species occurs in an arid environment, usually being encountered in small numbers in areas of desiccated grasses, often where scattered conifers are found on low hills and ridges It may also be found on the grassy open of the Great Plains, but is much less apt to occur there than in situations such as those described above

Individuals leap vigorously and can also fly, their small size and obscure coloration resulting in the usually rather small number present being easily overlooked. Locally, however, the species sometimes appears moderately abundant

Adults probably make their first appearance near the middle of July, surviving late into the fall

Cordillacris crenulata (Bruner)

1890 *Ochrilidia? crenulata* Bruner, Proc U S Nat Mus, XII, p 51 [Lectotype, previously selected ♂, Fort Robinson, Nebraska]

1897 *Alpha crenulata* McNeill, Proc Davenport Acad Nat Sci, VI, p 247

Pine Ridge, September 2, 1924, 8 ♂, 9 ♀

Newell, August 23, 1924, 1 ♂

Battle Mountain, east of Hot Springs, 3750 to 4400 feet, July 21, 1909, (J A. G Rehn), 2 ♂, 1 juv. ♀

There are also paratypes in the author's collection from Hot Springs, South Dakota

This diminutive species has been reported from Montana, Wyoming, Colorado, the panhandle of Texas, southwestern South

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[16] This record is based on a specimen which is intermediate between *occipitalis occipitalis* and *occipitalis cinerea*

Dakota and northwestern Nebraska That portion of the originally described series from Silver City, New Mexico, however, represents the allied *C apache* Rehn and Hebard

The present species is often found with *C occipitalis* (Thomas), but prefers the short grasses of the plains, particularly in gravelly areas and is there usually much more abundant, though often scarce on the low hills and ridges The season of adult appearance of these species is probably much the same

Phlibostroma quadrimaculatum (Thomas)

1871 *St[enobothrus] quadrimaculatus* Thomas, Prelim Rept. U S Geol Surv Wyoming and Terr, II, p 280 [♀, southern Colorado]

1897 *Phlibostroma quadrimaculata* McNeill, Proc Davenport Acad Nat Sci., VI, p 248

Synonyms are *Phlibostroma pictum* Scudder and *Stenobothrus laetus* Uhler

Chamberlain, Bijou Hills, Mobridge, Capa, Interior, Pine Ridge, Buffalo, Castle Rock in Harding County, Newell, Nisland, Spearfish, Whitewood, Battle Mountain east of Hot Springs and Hot Springs

The adults in the present series of ninety-three specimens were secured between July 26 and September 29

This is one of the commonest species of the Great Plains, its distribution extending north to Bismarck, North Dakota, Aweme, Manitoba, Walsh, Moose Jaw and Medicine Hat, Saskatchewan, and Banff and Calgary, Alberta Westward it is found to the Rocky Mountains in Wyoming and Colorado, in New Mexico being known from as far as Silver City In Nebraska it reaches eastward to the central portion of the state and in Kansas has been recorded from Garden City, while we have material from Barber County The southern limits of distribution of this and many other Great Plains species are as yet little understood, but in the present case the insect has been recorded as far south as northern Chihuahua, Mexico

Chloealtis conspersa Harris

1841 *Locusta Chloealtis conspersa* Harris, Rept. Ins. Massachusetts Inj Veget, 1841, p 149 [Massachusetts]

1920. *Chloealtis conspersa* Morse, Proc Boston Soc Nat Hist, XXXV, p. 438

The established synonyms are *Locusta abortiva* Harris and *Stenobothrus melanopleurus* Scudder

Waubay, Lake Hendricks, White, Brookings, Elk Point, Springfield, Capa, Buffalo, Spearfish, Whitewood, Englewood, State Game Park, Game Lodge and Hot Springs

Two females are macropterous, in the present series of forty-five specimens, taken from July 8 to September 17

This handsome grasshopper appears adult in late June and is usually found in small numbers in bushy pastures and on the edges of woodlands in dry situations, particularly where bits of wood are lying about, in which the females oviposit

It is found from New England south to northern Virginia and in the Appalachian Mountains to North Carolina, north and west to the Severn River, Ontario, Dog's Head, Manitoba, Banff, Alberta, and in British Columbia to the 52d parallel The insect, however, has not been found west of South Dakota anywhere on the Great Plains, southward being known from northern and eastern Nebraska and Magazine Mountain and northwestern Arkansas Gillette's record of this species from Fort Collins, Colorado, is almost certainly based on material of *C abdominalis* (Thomas)

Chloealtis abdominalis (Thomas)

1873. *Ch[rysochraon] abdominalis* Thomas, Rept U S Geol Surv Terr, V, p 74 [♀, Montana.]
1906 *Chloealtis abdominalis* Rehn and Hebard, Proc Acad Nat Sci Phila, 1906, p 367

Whitewood, State Game Park, Sylvan Lake at 6300 feet and Hot Springs.

Thirty-nine specimens represent this rather uncommon species, taken from August 27 to September 17. It appears adult considerably later than *C. conspersa* Harris, but may be found so early in August

It appears to prefer hills and mountain slopes with a scattering growth of trees and is usually encountered in small numbers.

The distribution is apparently discontinuous, the insect having been recorded as far east as the Severn River, Ontario. It is known from several localities on the Upper Peninsula and Gogebic County *in the Lower Peninsula of Michigan*, Bemidji, Minnesota; North Dakota, numerous localities in Manitoba, Saskatchewan, Alberta, and British Columbia as far north as the Chilcotin District, and from the Yellowstone Park, Wyoming. The Rocky Mountains carry its range far southward, it having been recorded from Manitou and Willow Creek, Colorado, and from Beulah, Truchas Peak and the Sacramento Mountains at Cloudcroft, New Mexico.

Orphulella pelidna (Burmeister)

1838 *G[omphocerus] pelidnus* Burmeister, Handb Ent , II, Abth II, pt I, p 650 [Pennsylvania]
1920 *Orphulella pelidna* Morse, Proc Boston Soc Nat Hist , XXXV, p 436

The synonyms of this species are Scudder's *Stenobothrus maculipennis* and *propinquans* and his *Orphulella pratorum*

Sisseton, Big Stone, Milbank, Brookings, Elk Point, Waubay, Hecla, Springfield, Wessington Springs, Martin, Buffalo and Newell

The series of one hundred and thirty-one specimens was secured between August 5 and September 26, the large majority having been taken at Waubay on the same day, August 21, 1924

This is one of the most abundant grasshoppers in the grasses of open or wooded country of the southeastern United States, extending northward, but much scarcer and more local in distribution, to the borders of the Canadian Zone In the south its range westward is continued far across Texas and Oklahoma, but it is apparently scarce west of central Kansas and Nebraska and may not occur west of the above South Dakota localities until the Rocky Mountains are reached On the Plains, at the foot of those mountains, the species has been recorded from a number of localities, but we believe that generally over the Great Plains it is absent or occurs only in very restricted areas. The species has also been found at Albuquerque and Mesilla, New Mexico, having very possibly reached there from the north rather than from the east Its northern limit in the west is shown by a male, now before us, from Baldur, Manitoba.

There is still much synonymy to be cleared up in this genus, this affording one of the major reasons for uncertainty as to the western limits of distribution of *pelidna*, though we believe that Californian records of the species were almost certainly based on incorrect determinations

In South Dakota the species is apparently rather scarce, though it has been reported from North Dakota as "fairly common throughout the eastern part of the state" and from Nebraska (as *maculipennis*) as moderately common in the eastern and middle portions. In these regions it probably appears adult in midsummer

Orphulella speciosa (Scudder)

1862 *St[enobothrus] speciosus* Scudder, Boston Jour Nat Hist , VII, p 458. [♂, St. Paul, Minnesota]
1920. *Orphulella speciosa* Morse, Proc Boston Soc. Nat Hist , XXXV, p 435.

The synonyms of this species are Scudder's *Stenobothrus aequalis*, *bilineatus* and *gracilis*

Sisseton, Big Stone, Waubay, Hecla, Watertown, Lake Hendricks, Lake Oakwood, White, Brookings, Canton, Elk Point, Volin, Springfield, Chamberlain, Mobridge, Pierre, Bijou Hills, Capa, Philip, Interior, Rapid City, Rosebud, Lemmon, Bison, Buffalo, Newell, Spearfish and Hot Springs

The series of two hundred and seventy-two specimens here recorded was taken from July 10 to October 4

Enormously abundant in favorable localities in New England, this insect occurs in the East from that region to the Piedmont of northern Virginia and in the Appalachian Mountains to Linville, North Carolina Northward it is recorded from Toronto, Ontario, but is limited to local areas in Indiana and Illinois, appearing again abundantly in the Lower Peninsula of Michigan, Minnesota, at Aweme, Manitoba,[18] in North and South Dakota, Iowa, Nebraska and Kansas, and reported westward to the Yellowstone Valley of Montana by McNeill Southwestward it has been found on Chehawhaw Mountain, Alabama and at Shreveport, Louisiana

It is evident that this insect prefers dry, though not very dry, grasslands and is more boreal than the majority of the species of the genus This probably accounts for its absence over all but the northern portions of the Great Plains

Like *O. pelidna* (Burmeister), the present species is subject to decided individual variation, while a multitude of color phases are blended in many ways

Dichromorpha viridis (Scudder)

1862 *C[hrysochraon] viridis* Scudder, Boston Jour Nat Hist, VII, p 455 [♂, ♀, Connecticut]

1920 *Dichromorpha viridis* Morse, Proc Boston Soc Nat Hist, XXXV, p 432

Established synonyms are *Chloealtis punctulatus* Scudder, *Opomala brevipennis* Thomas and *Truxalis angusticornis* Stål

Canton, Vermilion, Elk Point, Yankton and Springfield

The sixteen adults at hand were secured between July 24 and September 9

This is a common species in the eastern United States, reaching northward to central Massachusetts, the Great Lakes and in Minnesota to the Minnesota Valley. It is not known from North Dakota and in South Dakota is probably limited to the extreme southeastern portion It is reported as rather rare in Iowa In Nebraska it reaches westward to the middle portion of the state and in Kansas as far as Barber County The westernmost records to the south are Shawnee, Oklahoma, and Denison, San Antonio and Carrizo Springs Texas

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[18] A pair, taken October 1, 1924 by N Criddle, are in the author's collection

Inhabiting weedy spots, grassy fields and overgrown depressions, the insect is frequently encountered over its wide range, but rarely in large numbers In South Dakota it probably appears adult early in July

Chorthippus curtipennis curtipennis (Harris)[17]

1841 *Locusta* (*Chloealtis*) *curtipennis* Harris, Rept Ins Massachusetts Inj Veget, 1841, p 149 [♂, ♀, Massachusetts]
1920 *Chorthippus curtipennis* Morse, Proc Boston Soc Nat Hist, XXXV, p 440

Recorded synonyms are *Stenobothrus longipennis* Scudder and *Stenobothrus coloradensis* McNeill

Sisseton, Big Stone, Lake Hendricks, Brookings, Hecla, Springfield, Mobridge, Lemmon, Buffalo, Newell, Whitewood, Englewood and State Game Park

The series of forty-six specimens was taken from August 6 to September 2

In the east this insect is known from Spruce Brook, Newfoundland to central New Jersey and in the Appalachian Mountains south to North Carolina Westward its distribution includes the northern United States and southern Canada to British Columbia, where intergradation with *C curtipennis oregonensis* Scudder occurs It is not found on the Great Plains, though abundant in the mountains of Montana, Wyoming and Colorado, extending there as far south as Cloudcroft, in the Sacramento Mountains of New Mexico Though widely distributed in favorable local environment in North Dakota and Nebraska, it has not been reported from Kansas Revision is necessary before the western limits of distribution can be determined, the status of the species of the genus, described from the far west, being yet somewhat uncertain and the areas which they cover not defined

The species inhabits areas of rich grass, particularly in marshy environment, and though often local in distribution as a result, it is usually encountered in very large numbers It appears adult early in July

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[17] See Rehn in Buckell, Proc Ent Soc British Columbia, No 20, Syst Ser. p 20, (1922)

Gomphocerus clavatus Thomas

1873 *G[omphocerus] clavatus* Thomas, Rept U S Geol Surv Terr, V, p 96 [♂, Kansas, (in error?[18])]
1874 *Gomphocerus carpenterii* Thomas, Bull U S Geol Surv Terr, Hayden, I, p 65 [♂, near Mountain of the Holy Cross, Colorado, at 8000 to 10000 feet]
1875 *Gomphocerus clepsydra* Scudder, in Dawson, Rept Geol. and Resources 49th Parallel, p 344 [♀, Souris River, southwestern Manitoba]
1906 *Gomphocerus clavatus* Rehn and Hebard, Proc Acad Nat Sci. Phila, 1906, p 370
1914 *Gomphocerus clepsydra* Somes, Univ Minnesota Agr Exp Sta. Bull 141, Tech, p 30

In 1903 Caudell placed *carpenterii* and *clepsydra* as synonyms of *clavatus* The synonymy of *clepsydra* was again indicated by E M Walker in 1910

In spite of these decisions, we do not feel satisfied with recognizing the synonymy of *clepsydra* as final Only two species of the genus are known from North America *clavatus* and the Mexican *G meridionalis* Bruner With the present-day better understanding of geographic races, however, the stunted form of *clavatus* from the high Rockies, the males of which have slightly thickened cephalic tibiae,[19] may prove separable racially from that of the Great Plains, and the name *clepsydra* would then be available for the latter geographic race. This point will be definitely decided only after detailed revision, with large series for the necessary comparison

Lake Hendricks, Lake Oakwood, Brookings, Capa, Rosebud, Philip, Martin, Rapid City, Newell, Spearfish, Whitewood, Deadwood, Smithwick, Battle Mountain east of Hot Springs and Hot Springs.

This series of ninety-two specimens includes adults taken from June 21 to August 14 In South Dakota the species reaches maturity in the late spring and appears to become very scarce by the first of August

This interesting insect ranges from western Minnesota through southern Manitoba, Prince Albert, Saskatchewan, and Alberta to the Rockies It is known from many localities in North Dakota and in Nebraska is said to be quite common in the middle and eastern portions of the state Though abundantly present on the dry grassy uplands throughout its range it has been rarely found on the Great Plains of Colorado, but is known from many localities in Montana and Wyoming In the Rocky Mountains of Colorado and New Mexico the species is frequently encountered and has been taken as far south as Cloudcroft, in the Sacramento Mountains of the latter state

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[18] This specimen was sent to Thomas by Dodge and was apparently mislabelled, as the species may not occur in Kansas and that specimen, showing slight thickening of the cephalic tibiae, very probably came from a high elevation in the Rocky Mountains

[19] Thomas had evidently not seen males of *G sibiricus* (Linnaeus) in comparing his male of *carpenterii*, as in that species the males have the cephalic tibiae greatly swollen, piriform and very distinctive

Platybothrus brunneus (Thomas)

1871 *St[enobothrus] brunneus* Thomas, Prelim Rept U S Geol Surv Wyoming and Terr, II, p 280 [♂, ♀, Cañon City, Colorado]

1906 *Platybothrus brunneus* Rehn and Hebard, Proc Acad Nat Sci. Phila, 1906, p 369

Battle Mountain, east of Hot Springs, 3750 to 4400 feet, July 21, 1909 (J. A G Rehn), 3 large juv ♀, 2 small juv ♀

The above record and those from Regina, Saskatchewan, Amidon, North Dakota, and western Nebraska, represent the extreme eastern limits of the species distribution It has not been found on the Great Plains themselves, a rather odd feature of its distribution as, in its favorite mountain habitat, it occurs in areas of short, dry grasses and not in the richer grasses of such environment. The species is known from the Rocky Mountains in central and northern Colorado, Wyoming, Montana, and Idaho[10] and from British Columbia, where, in the Chilcotin District, it has appeared in great abundance, damaging considerably the grasses of the cattle range. It has been recorded from Goodlands, Manitoba, and also occurs at Kipp, Alberta [11]

The first adults probably appear in South Dakota in late July.

The large and handsome *Boopedon nubilum* (Say) should be found along the southern border of central South Dakota, as it has been reported from Nebraska as "more common northward than elsewhere." It has also once been reported from Iowa, without definite locality. The species is one of the most striking which inhabits the richer grassy areas of the Great Plains.

The males are medium sized, largely black, with organs of flight extending to apex of abdomen. The females are much larger, light brown or green marked with dark brown (rarely melanistic like the males) and with tegmina covering scarcely half the abdomen

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[10] We are satisfied that the species does not occur in California, though such has been stated by McNeill and Scudder

[11] A male is before us, taken August 10, 1919, by N Criddle

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Another beautiful species, *Boopedon savannarum* Bruner, is known only from the small series originally described, which was taken at West Point, Nebraska, "on sand hills and prairies " This species shows the same sexual difference in size as *nubilum*, but both sexes are dark brown with lateral lobes of pronotum narrowly margined cephalad and caudad with buffy, and tegmina represented by oval pads, with apices sharply rounded

This insect may occur in southeastern South Dakota

Stethophyma gracile (Scudder)

1862 *A[rcyptera] gracilis* Scudder, Canadian Nat and Geol, VII, p 286 [♂, probably Winnipeg, Manitoba, Maine]
1920 *Mecostethus gracilis* Morse, Proc Boston Soc Nat Hist, XXXV, p 444

The genus *Mecostethus* Fieber has been definitely fixed as that which has long been recognized as *Parapleurus* Fischer The three North American species concerned were, unfortunately, transferred to *Arcyptera* Serville, instead of to *Stethophyma* Fischer, where they unquestionably belong

Not only is *Stethophyma* separated from its allies by the very small, triangular foveolae of the fastigium, but in the male sex, instead of having the medio-longitudinal internal carina of the caudal femora finely denticulate (as is usual), this carina is smooth, but analogous denticulations occur instead on the intercalary vein of the tegmina and on some of its transverse veinlets

Englewood, August 30, 1924, 2 ♂, 1 ♀ State Game Lodge at 4000 feet, September 7, 1923, 2 ♂, 1 ♀ State Game Park, September 2, 1924 and September 6, 1923, 3 ♀

This insect has been previously recorded from the Black Hills in South Dakota It reaches maturity late in the season and is not apt to be found adult before the first of August Inhabiting wet sedgy meadows as well as bushy swamps, its distribution is very local and, though the males are active, fly vigorously and stridulate loudly, the heavier females are much less easily found, then usually ready to leap down into the thickest tangle of grasses at the first alarm

The insect has been reported from Port-aux-Basques, Newfoundland, to Anglesea, New Jersey, and westward from Ontario, Michigan, Manitoba, Minnesota, North Dakota, Nebraska, Radisson, Saskatchewan, Edmonton and New Lunnon, Alberta, and as far northwest as the Chilcotin District, in British Columbia

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As *Stethophyma lineatum* (Scudder) has been reported from eastern Nebraska, it may also occur in eastern South Dakota, where search should be made in wet sedgy grass areas and in bogs and swamps. It is a larger and darker insect than *gracile*, with a pale tegminal line

Stethophyma platyptera (Scudder)

1862 *A[rcyptera] platyptera* Scudder, Boston Jour Nat Hist, VII, p 462 [♀, New England]

1920 *Mecostethus platypterus* Morse, Proc Boston Soc Nat. Hist, XXXV, p. 446.

Springfield, August 6, 1924, 5 ♂, 1 ♀

The distribution of this handsome species is highly discontinuous and it is very much less frequently encountered than either *S gracile* or *S. lineatum* Like those species it inhabits bogs and sedgy areas

It has been recorded from Sherborn, Massachusetts, Thompson, Connecticut, Teheran and Champaign, Illinois, Mesaba and Allen Junction, Minnesota, Little Rock, Iowa, and Cambridge, Nebraska

Stirapleura delicatula (Scudder)

1876[22] *Scyllina delicatula* Scudder, Bull Geol Geogr Surv Terr, II, p. 263 [♂, Garden of the Gods, Colorado]

1876[23] *Psoloessa coloradensis* Thomas, Proc Davenport Acad Nat Sci, I, p 252. [♂, ♀, Denver, Colorado]

1876[24] *Stirapleura decussata* Scudder Ann Rept Chief Engineers for 1876, App JJ, p 510 [♀, southern Colorado]

After careful comparison of material from numerous localities in Colorado and study of the original descriptions, we feel satisfied as to the synonymy noted above Scudder's *decussata* was separated from his *delicatula* by McNeill on the slightly longer foveolae alone These foveolae of the vertex are subject to some variation in contour and the difference noted certainly has no diagnostic value McNeill first recognized that *coloradensis* and *decussata* represented the same species

Capa, Rosebud, Philip, Martin, Pine Ridge, Creston, Rapid City, Hot Springs and Smithwick

The sixty-five individuals here recorded were secured from

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[22] Separate dated June 6, 1876.

[23] Dated July, 1876

[24] Letter of transmission dated May 29, 1876

April 23 to June 29 By midsummer the species has largely disappeared over the greater portion of its range

This insect is widely distributed in Colorado, Wyoming and Montana, but the limits can not be better defined south and westward, due to probable confusion there with other species of the genus Northward it has been recorded (under the synonymic name *decussata*) from numerous localities in British Columbia, Alberta, Saskatchewan, and Aweme, Manitoba, and eastward as far as Devils Lake, North Dakota, central Nebraska, and Hamilton and Morton Counties in southwestern Kansas

The species prefers gravelly areas scantily clothed with short grasses, particularly in hilly country and on the Great Plains In Colorado it has been secured as high as an elevation of 8000 feet

Though probably locally abundant at the height of its season, the insect has become decidedly scarce at most localities at the time that collecting of Orthoptera is usually undertaken

Psoloessa texana Scudder

1875 *Psoloessa texana* Scudder, Proc Boston Soc Nat Hist, XVII, p 512 [♂, ♀, Dallas, Texas]

1908 *Psoloessa texana* Rehn and Hebard, Proc Acad Nat Sci Phila, 1908, p 381

1909 *Psoloessa texana* Rehn and Hebard, Proc Acad Nat Sci Phila, 1909, p 144

Established synonyms are Scudder's *ferruginea*, *maculipennis* and *buddiana* and Rehn's *Stirapleura mescalero*

Martin, June 24, 1924, 5 ♂, 9 ♀ Pine Ridge, June 25, 1924, 1 ♂.

The above records define the known northern limit of the insect in this longitude Southward it has been reported from the sand hill region of Nebraska (as *ferruginea*) and from Clark County, Kansas From Dallas, Texas, it is known to extend southward and westward to southern California, being one of the most generally distributed species of the semi-arid southwestern United States and adjacent Mexico In Colorado it has been reported from the southern portion of the state and from Colorado Springs

Ageneotettix deorum (Scudder)

1876 *Chrysochraon deorum* Scudder, Bull Geol Geogr Surv Terr, II, p 262. [♂, Garden of the Gods, Colorado]

1906. *Ageneotettix deorum* Rehn and Hebard, Proc Acad Nat. Sci Phila., 1906, p 371

Lake Hendricks, Sioux Falls, Canton, Elk Point, Waubay, Volin, Hecla, Springfield, Wessington Springs, Chamberlain, Bijou Hills, Mobridge, Pierre, Capa, Interior, Lemmon, Wasta, Buffalo, Rapid City, Newell, Nisland, Spearfish, Whitewood, Deadwood and Hot Springs

Rehn and Hebard synonymized Bruner's *scudderi* and *occidentalis* in 1906 and Blatchley has done the same for Hancock's *arenosus* in 1920 The status of *A australis* Bruner is still, however, undecided

One hundred and twelve adults are represented, taken from July 5 to September 29, the first date being very probably very close to that of the first appearance of adults in this region

The insect is found very abundantly in eastern Colorado to the Rocky Mountains, north to Medicine Hat and the Saskatchewan Valley, Saskatchewan and Aweme, Manitoba Eastward it is known from numerous localities in Minnesota and in the local sandy areas of Illinois and Indiana, the easternmost being Terre Haute in the latter state, and Three Oaks, Michigan Southward it is generally distributed in Nebraska and has been reported from Caddo, Indian Territory and from numerous localities in the western portion of northern Texas and northern and eastern New Mexico Due to uncertainty as to the validity of *australis*, the western limits of the distribution of *deorum* can not be definitely given, though Rehn and Hebard have recorded it from Grand Junction and Antlers, Colorado, and Salt Lake City Utah

The species prefers a prairie or plains environment and in such regions is usually generally distributed and abundant in the fall, at which time the greatest number of adults are present

Aulocara elliotti (Thomas)

1870 *S[tauronotus] elliotti* Thomas, Proc Acad Nat Sci Phila, 1870, p 82 [♂, ♀, eastern Colorado]
1903 *Aulocara elliotti* Cooley, Bull 51, Montana Agr Exp Sta, pl IV, figs 3 and 4
1904 *Aulocara elliotti* Gillette, Bull 94, (Tech Ser No 6), Agr Exp Sta Colorado Agr Coll, p 29

Established synonyms are Scudder's *coeruleipes*, *decens* and *Oedocara strangulatum*

Interior, Buffalo, Newell, Nisland, Spearfish, Whitewood, State Game Lodge and Hot Springs

Sixty-three adults are before us, taken between June 28 and September 11

The insect is known in Canada only from Lethbridge, Alberta, and Vernon and the Lower Okanagan Valley in British Columbia In the Rocky Mountain states it has been reported from Montana, Wyoming, Utah, Colorado and New Mexico Its recorded eastern limits are Cache and Snyder, Oklahoma, Garden City, Kansas, middle and western Nebraska, and Buford and Amidon, North Dakota We have also examined material from the Wallowa Mountains, Oregon, and Muleshoe in Bailey County, Texas

It prefers the cattle ranges of the west, at times becoming exceedingly abundant and has been reported as decidedly injurious during such periods

Though appearing adult in late spring, the majority probably reach maturity about midsummer

Aulocara femoratum Scudder

1899 *Aulocara femoratum* Scudder, Proc Amer Acad Arts and Sci, XXV, p 55 [♂ Lakin, Kansas, Pueblo, Colorado, Provo, Utah]
1904 *Aulocara femoratum* Gillette, Bull 94, (Tech Ser No 6), Agr Exp Sta Colorado Agr Coll, p 20

Newell, Nisland, Spearfish and Hot Springs

The fourteen adults recorded were secured between August 23 and September 6

This is a trimmer, more conspicuously marked and less abundant species than the preceding Inhabiting a similar environment, it has a very wide distribution, though it is often quite local

It is reported very abundant near the foothills in northern Colorado, extending northward to the Marias River, Montana, (previously unpublished), and southwestward to Jimulco and Lerdo, in Durango, Mexico, and the Santa Rita Mountains, Huachuca Mountains and Phoenix, Arizona The previously known eastern limits of its range are Lakin, Kansas, and Quanah, Texas

Adults are usually found most numerous in the fall

OEDIPODINAE

Arphia pseudonietana (Thomas)

1870 *T[omonotus] pseudo-nietana* Thomas, Proc Acad Nat Sci Phila, 1870, p 82 [♂, near Cañon City, Colorado]
1895 *Tomonotus theresiae* Brunner, Berliner Ent Zeitschr, XL, p 277 [♀, Fort Yates, North Dakota]
1914 *Arphia pseudonietana* Somes, Univ of Minnesota, Agr Exp. Sta Bull 141, Tech, p 36

The established synonyms are *tenebrosa* Scudder, *sanguinaria* Stål and *ovaticeps* Saussure

We are pleased to be able to place *Tomonotus theresiae* Brunner in the present synonymy, a name which since its appearance has puzzled students of North American Orthoptera The description fits *pseudonietana* in every detail, and as it does not agree with the only other species of *Arphia* (to which genus the description alone applies) known from North Dakota, definite assignment to synonymy is possible

Big Stone, Lake Hendricks, Lake Oakwood, Brookings, Canton, Waubay, Yankton, Hecla, Chamberlain, Mobridge, Pierre, Fairburn, Capa, Interior, Martin, Lemmon, Buffalo, Rapid City, Newell, Spearfish and Hot Springs

This is the most abundant and generally distributed species of *Arphia* in South Dakota, the one hundred and twenty specimens here studied having been secured between August 5 and October 21

Two males from Hot Springs alone represent the melanistic color phase which sometimes occurs in the species Size and degree of development of the organs of flight individually vary greatly

Its distribution can not be very well detailed, as in the west other species have been confused with it Bruner's Mexican record is based on material, before us, of a distinct species, while Morse's record of *Arphia xanthoptera* (Saussure) from Quanah, Texas, is probably referable to the present insect

The distribution of *pseudonietana* probably covers the Great Plains and at least eastern portions of the Great Basin, reaching northward to British Columbia, Alberta, Saskatchewan, Manitoba, Nepigon and Sudbury, Ontario, Minnesota and Michigan (not including the extreme northern or the southern portions of the state), but is said to invade extreme northwestern Illinois, and we have examined a specimen from Amherst Junction, Wisconsin It is known from numerous localities in North Dakota and has been reported as very common generally in Nebraska and from a number of localities in western Kansas It has also been recorded from Iowa as the synonymous *tenebrosa* In the southwest Rehn has correctly recorded the species from Las Vegas and Albuquerque, New Mexico, and Jerome, Arizona

The species prefers areas of poor soil in a dry environment and is always found in the open It appears adult in the fall and is probably present as late as grasshoppers are able to survive

Arphia frigida Scudder

1845 *Arphia frigida* Scudder, Dawson's Rept. Geol. 49th Parallel, p 344 [♂, Yukon River, Alaska. ♀, Woods End, Assiniboia]

1914 *Arphia arcta* Somes, Univ of Minnesota, Agr Exp Sta Bull 141, Tech , p 37

Walker, we believe, correctly indicated the synonymy of *A arcta* Scudder, in 1910

Lake Hendricks, White, Canton, Springfield, Winner, Rosebud, Philip, Martin, Creston, Rapid City, Whitewood, Deadwood and Englewood

This is a spring form, which probably winters in the immature condition, represented by forty-nine adults taken from May 4 to July 18 and one immature secured November 9

In the majority of the present series the wings are orange, a few individuals alone having them yellow The caudal tibiae are buffy proximad, then with or without a broad suffused brown annulus and with distal extremity similarly darkened The large area between these annuli is brownish buff, or yellowish, with a very faint tinge of green or weak greenish glaucous, these differences being largely shown by material from different localities and, in consequence, not a matter of pure individual variation

The species is known from Alaska to Victoria on Vancouver Island, British Columbia, from numerous localities in Alberta and Saskatchewan and from Aweme, Manitoba The Rocky Mountains carry its distribution southward as far as Trout Spring, New Mexico, while it is known southwest in Utah to Parowan, and from Williams, Arizona Eastward its known limits are St Anthony Park, Minnesota, Iowa and Nebraska In the Colorado Rockies it reaches an elevation of 12000 feet

Arphia xanthoptera (Burmeister)

1838 *O[edipoda] xanthoptera* Burmeister, Handb Ent, II, Abth II, pt I, p 643 [Carolina]

1920 *Arphia xanthoptera* Morse, Proc Boston Soc Nat Hist, XXXV, p 451

After study of large series we question strongly the validity of Scudder's *Arphia carinata*, described from Iowa Furthermore Saussure's *Arphia crepusculum* from Texas may also fall, though in that region an average larger and more cristate form is developed. Reduction of these names to synonymy under *xanthoptera* must await a detailed study of all available material

Vermilion, September 9, 1924, 3 ♂

Springfield, September 7, 1924, 6 ♂, 4 ♀

A pair have pink wings, the others all having the wings yellow with an orange tinge.

This insect enjoys a very wide distribution in the East, from middle New Hampshire and Berrien County, Michigan, to Orange City Junction, Florida. The recorded western limits are. Pipestone, Minnesota, eastern Nebraska, Sedgwick County, Kansas, and Clarendon and Denison, Texas

The present species appears in the fall, preferring open woodlands and sandy fields

Arphia simplex Scudder

1875 *Arphia simplex* Scudder, Proc Boston Soc Nat Hist XVII, p 514 [♂, ♀, Dallas, Texas]
1875 *Arphia luteola* Scudder, Proc, Boston Soc Nat Hist, XVII, p 515 [♂, ♀, Dallas and Bosque County, Texas]
1905 *Arphia decepta* Bruner, Biol Cent-Amer, Orth, II, p 132 [♂, ♀, Cordoba, Orizaba,[16] San Rafael and Jalapa, all in Vera Cruz, Mexico

A series from near Dallas, Texas, compared with much material from other localities, convinces us that the name *luteola* is based on merely a striking color phase of *simplex* and must consequently be placed in the present synonymy In subsequent literature the name *simplex* has sometimes been reserved for small and pallid individuals and *luteola* for the optimum of both size and color pattern Such differences are clearly shown by the series at hand to have no specific or racial significance whatever

Bruner's *decepta* is also a synonym The type and paratypes before us have the pronotum only slightly rougher than is usual for the species, this feature alone being insufficient for diagnostic purposes The wing coloration is individually variable, ranging in our Mexican series from martius yellow through light salmon-orange to bittersweet-pink The size variation is not decided in this series, but is very considerable in Texas, where, however, the optimum developed is apparently the result of local environmental influences rather than due to geographic distribution Such were the major differences given by Bruner to separate *decepta* from *simplex* and, with no others existing, can not be considered sufficient for specific separation

Elk Point, June 16 to September 8, 1924, 4 ♂, 6 ♀

The above record represents the northernmost for this very handsome species, whose distribution extends southward to Vera Cruz, Mexico It is probably widely distributed in northeastern Mexico and in the United States has been reported (often as *luteola*) from Carrizo Springs, Spofford, San Antonio, Wichita

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[16] A female from this locality has been selected as single type, Hebard Collection Type No 273

Falls, Denison and Dallas, Texas, Caddo and Howe, Oklahoma, and Sedgwick County, Labette County and Topeka, Kansas[26] We have also material from Lincoln and Roca, Nebraska

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We have before us a specimen of the widely distributed eastern *Arphia sulphurea* (Fabricius) from Iowa City, Iowa Bruner reports it as not common in eastern Nebraska, but examination of his material proves that to be an incorrect determination, based on other species of the genus It has, however, been recorded from numerous localities in Minnesota, including Pipestone, and will therefore almost certainly be found in extreme eastern South Dakota The insect inhabits rather open woodlands and appears adult early in the spring, adults probably being no longer present at the time the majority of species have reached their greatest adult abundance

Chortophaga viridifasciata (DeGeer)

1773 *Acrydium viridi-fasciatum* DeGeer, Mém Hist Nat Ins, III, p 498 [♀, Pennsylvania]

1920 *Chortophaga viridifasciata* Morse, Proc Boston Soc Nat Hist, XXXV, p 455

Seven synonyms are known, all of them long established

Lake Hendricks, Brookings, Garretson, Salem, Canton, Elk Point, Yankton, Springfield, Pierre, Rapid City, Whitewood and Hot Springs

Sixty-one specimens are before us, the adults taken between April 20 and September 17 The species is probably the first grasshopper to appear in the spring, except certain grouse-locusts, and is probably double brooded in South Dakota, adults being consequently found occasionally in the fall as well

In the east it is found everywhere from New England and southern Ontario south to the boundary of the southeastern Sabalina Zone, in which it is supplanted by *Chortophaga australior* Rehn and Hebard Westward, however, it reaches the Gulf of Mexico and has been recorded from Brownsville, Texas, Mesilla and Las Vegas, New Mexico, Fort Collins, Colorado, in Utah south to Richfield, and north to Maple Creek, Moose Jaw, Saskatchewan, and Manitoba There is also a questionable record from Victoria, British Columbia North and west of Texas, however, we do not believe that it is anywhere as abundant or as generally distributed as in the east

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[26] Saussure's record of *simplex* from California is certainly in error, as are those by Scudder from Denver, Colorado and Utah

Areas of rich grass are preferred by the species, though it may be found in almost any open environment which is not marshy or very arid

Encoptolophus subgracilis Caudell

1903 *Encoptolophus subgracilis* Caudell, Proc Ent Soc Washington, V, p 163 [♂, ♀, Phoenix, Arizona]
1905 *Encoptolophus texensis* Bruner, Biol Cent -Amer, Orth, II, p 142 [♂, ♀, El Paso and Carrizo Springs, Texas, Mesilla, New Mexico[27], Queretero and Lerdo in Durango, Mexico]

We have indicated and discussed the synonymy of *texensis*, in a paper which will appear shortly [28]

Elk Point, September 8, 1924, 4 ♂, 4 ♀, Capa, August 7, 1919, 1 ♀

The addition of this species to the South Dakota list comes as a very decided surprise Though widely distributed in the southwestern United States and adjacent Mexico, the insect had not been previously recorded north of Dallas, Texas, nor is it represented in large collections before us from Kansas and Nebraska, through which states it has undoubtedly reached South Dakota

The Capa individual is of normal size but those from Elk Point are unusually small and dark

The species prefers waste areas where the ground is bare or supplied with very scant weeds In the semi-arid southwest it is often found on flat bare areas in the vicinity of dry water courses

In addition to the localities given in the above references the species has been recorded from Brownsville, Spofford, and Ysleta, Texas, Roswell, Alamogordo, Mesilla, Albuquerque, Aden and Deming, New Mexico, and San Bernardino Ranch, Tucson and Florence, Arizona

Encoptolophus costalis (Scudder)

1862 *O[edipoda] costalis* Scudder, Boston Jour Nat Hist, VII, p 473 [♀, Texas]
1875 *Encoptolophus parvus* Scudder, Proc Boston Soc Nat Hist, XVII, p 480. [♂, Dallas, Texas]
1904 *Encoptolophus coloradensis* Bruner, Bull 94, Agr Exp Sta Colorado Agr Coll, p 58. [♂, ♀, Fort Collins, Colorado]
1905 *Encoptolophus montanus* Bruner, Biol Cent -Amer, Orth. II, p 140 [♂, ♀, Bozeman, Montana]
1906 *Encoptolophus coloradensis* Rehn and Hebard, Proc Acad Nat Sci Phila, 1906, p 374

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[27] The recorded paratype from "southern California" is probably incorrectly labelled.

[28] Trans Amer Ent Soc, LI, (1925)

Large series from Dallas, Texas and other localities in that state and Colorado, and the type series of *montanus*, compared with the original description of *costalis*, offer conclusive evidence of the three synonyms given above The name *parvus* was based on a small, obscurely colored male, the difference from the female type of *costalis* being wholly attributable to individual variation Bruner described *coloradensis* clearly without effort to ascertain any difference from the Texan species, and no differences are to be found His later description of *montanus* is even more at fault, in a series of fourteen males and sixteen females which he had from Bozeman, Montana, a pair only were studied, the female alone representing a largely green color phase, occasionally developed in the species Though the described male and all the other specimens of this series are of the usual brown phase, Bruner used "insect frequently in large part green" to separate his *montanus*, evidently the only feature of difference of any sort which he could find, but represented in the original series by but one of the thirty specimens!

Lake Oakwood, Wessington Springs, Mobridge, Pierre, Chamberlain, Bijou Hills, Capa, Interior, Buffalo, Castle Rock in Harding County, Newell and Whitewood

The series of one hundred and seventy-six specimens was secured between August 5 and September 11, three males and twenty-one females being of the green color phase This is one of the latest species to appear adult, probably being present as late in the fall as any of the Great Plains grasshoppers

It prefers open grasslands and is apparently much more abundant in all but extreme eastern South Dakota than westward on the higher Great Plains

The known northern limits of distribution are defined by Lethbridge, Alberta[29], numerous localities in Saskatchewan, and Aweme, Manitoba Eastward it has been reported from many localities in North Dakota, Caddo, Indian Territory, and Denison, Texas, while specimens from Nebraska and Kansas are before us[30] In western Texas and New Mexico it probably extends to the Mexican border, but previous records of *costalis* and *parvus* from Mexico and El Paso, Texas, are apparently all referable to other species Westward it has been recorded from Antonito and Fort Collins, Colorado, and Bozeman, Montana

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[29] We have seen a male taken September 6 to 7, 1924, by N Criddle, belonging to the Canadian National Collection.

[30] Scudder's Missouri record is questionable

Encoptolophus sordidus (Burmeister)

1838 *O[edipoda] sordida* Burmeister, Handb Ent, II, Abth II, pt I, p 643 [♂, Pennsylvania]

1920 *Encoptolophus sordidus* Morse, Proc Boston Soc Nat Hist, XXXV, p 458

The only synonym is *Locusta nebulosa* Harris

Big Stone, Milbank, Lake Hendricks, Lake Albert, Brookings, Canton, Vermilion, Elk Point, Yankton and Springfield

The fifty-five adults here recorded were taken between August 14 and September 8

We have encountered a most unexpected difficulty Typically *sordidus* and *costalis* may be distinguished at a glance, the former being heavier and darker (never developing a green phase) with broader, flat fastigium and caudal tibiae blackish except for a pale proximal annulus In the region where the distribution of these insects meets, however, the differences become less, so that in some of the above series a slightly wider vertex and dark caudal tibiae (though occasionally showing a bluish tinge) remain the weakly defined features by which they may be separated from typical *costalis* That these features are variable in this area is further shown by the Lake Oakwood series, which is recorded as *costalis* solely because the fastigium is slightly narrower than in the narrowest recognized as *sordidus*, the caudal tibiae are bluish and two females are of the green phase

Revisionary study of the genus may show that *sordidus* and *costalis* are only geographic races of a single species The present evidence points strongly to that conclusion, but geographic races are rarely as distinct in their typical condition and we would not advise such action until the genus has received more general and detailed study

This is an eastern insect, found from New England and southern Ontario to North Carolina in the Piedmont section Westward its known range is bounded on the north by Wayne and Washtenaw Counties in Michigan, Mahtomedi and Fergus Falls, Minnesota, on the west by eastern Nebraska, and McPherson and Sedgwick Counties, Kansas, and on the south by Tennessee

It appears late in the season and, unlike *E costalis* (Scudder), prefers waste weedy areas rather than prairie or plains conditions

Camnula pellucida (Scudder)

1862 *O[edipoda] pellucida* Scudder, Boston Jour Nat Hist, VII, p 472 [♂, Massachusetts, Vermont, Maine, Connecticut]

1920 *Camnula pellucida* Blatchley, Orth of North-Eastern America, p 261

Long established synonyms are *Oedipoda atrox* Scudder, *Camnula tricarinata* Stål and *Stenonothrus obionus* Thomas

Pierre, Capa, Newell, Whitewood, Spearfish, Englewood, Deadwood and Sylvan Lake

The twenty-nine specimens were taken from June 28 to September 11 The species is an inhabitant of grasslands and appears in very great numbers over a large portion of its very extensive range, causing more general annual damage than any other North American grasshopper Areas of short grass, best for grazing purposes, are always the most infested

The species is widely distributed in Canada from Newfoundland to British Columbia, the southernmost records being northern Connecticut, in the Appalachians south to Monterey, Virginia, northern Indiana and Illinois, western Nebraska, in the Rocky Mountains south to Valencia County on the Continental Divide, New Mexico, across the Arizona Plateau, and in California to the Mexican Border It is, however, probably absent from the southern Great Plains

Pardalophora apiculata (Harris)

1835 *Locusta apiculata* Harris, in Hitchcock, Rept Geol Massachusetts, 2d Edit, p 576 [♀, United States]
1920 *Pardalophora apiculata* Morse, Proc Boston Soc Nat Hist, XXXV, p 462

Established synonyms are Burmeister's *obliterata* and Harris' *corallina,* while the insect has frequently been recorded as *tuberculatus*, due originally to an error by Beauvois

Elk Point, Rosebud, Black Hills, Whitewood and Hot Springs.

The eleven adults were secured from May 24 to July 8

This is the largest and handsomest of the eastern spring grasshoppers Though occurring in a variety of situations, the insect prefers upland meadows It is usually found in small colonies and is rarely numerous.

This species ranges from Maine to New Jersey, in the Appalachians extending southward to North Carolina. Westward it has been recorded from Montreal, Quebec, Toronto and Nepigon, Ontario; Aweme and Dufferin, Manitoba, numerous localities in Saskatchewan, Red Deer and Calgary, Alberta, and from Alkali Lake in the Chilcotin District of British Columbia In the far north it is known from Hudson Bay, the Great Slave Lake and the Upper Mackenzie River. Its southern limits in the United States are defined by Pineville, Lexington and Tyrone, Kentucky, Missouri, Clark County, Kansas, Sedalia, Colorado, the Big Horn Mountains and Fort McKinney, Wyoming, and Montana

Pardalophora haldemanii (Scudder)

1872 *Oedipoda haldemanii* Scudder, U S Geol Surv Nebraska, Final Rept, p 251 [♂, ♀, Nebraska City and Platte River, Nebraska]
1892 *Hippiscus X[anthippus] tigrinus* Scudder, Psyche, VI, p 334 [♀ base of Rocky Mountains, West Point, Nebraska, Nebraska, Fort Buchanan Arizona, no locality]
1914 *Hippiscus haldemani* Somes, Univ Minnesota Agr Exp Sta Bull 141, Tech, p 45

We select as single type of Scudder's *tigrinus* the only non-alcoholic specimen of the original series bearing definite data, taken at West Point, Nebraska, July, 1887, by L. Bruner, (Hebard Collection, Type no 977) This specimen is typical of *haldemanii*, except that the median carina of the pronotal prozona shows some depression at the point where sulcation, in the forms of *Xanthippus*, would be found The difference clearly represents a slight individual variation and *tigrinus* consequently falls in the present synonymy Of the balance of the original series, the specimen from the "base of the Rocky Mountains, Colorado?" probably actually came from western Kansas, while the individual from Arizona almost certainly represents a different species

Lake Hendricks, Garretson, Canton, Elk Point, Yankton, Springfield, Wessington Springs, Capa, Rosebud, Philip, Buffalo, Rapid City, Smithwick, Pine Ridge, Newell, Spearfish and Whitewood

The series of one hundred and twenty-three specimens was secured from June 16 to August 25, the species evidently appearing adult in largest numbers during late June

All but twenty-six have the internal and ventral surfaces of the caudal femora and the caudal tibiae yellowish buff, often with an orange tinge, the ventral surface of the caudal femora frequently with a longitudinal dark brown suffusion The others have the ventral and internal surfaces of the caudal femora and the caudal tibiae, brilliant nopal red This striking color difference is plainly shown by the present large series to be a matter of mere individual variation Our sincere thanks are due to Dr. Severin, through whose coöperation so large a series was secured, enabling a definite decision as to the significance of the very different coloration found in individuals of *Pardalophora* which show no structural diversity

This species has been correctly recorded from Pine, Lake County, Indiana; southern Illinois, Fergus Falls, Granite Falls and St Paul Park, Minnesota, Amidon, North Dakota, Little Rock and Ames, Iowa (reported as common in that state), eastern and middle Nebraska (reported as common), and eastern Kansas

Xanthippus montanus (Thomas)

1872 *O[edipoda] montana* Thomas, Rept U S Geol Surv Montana, p 462 [♀, upper Snake River plains and southern Montana]

1892 *Hippiscus X[anthippus] montanus* Scudder, Psyche, VI, p 361

Martin, June 24, 1924, 2 ♂

This species enjoys a wide but very discontinuous distribution, being largely, if not solely, encountered in sandy areas We are able to verify as correct Bruner's and Scudder's records from Holbrook, Arizona, Taos Valley, New Mexico, and southwestern Holt County, Nebraska Additional material is before us from Colorado Springs and Sterling, Colorado, and War Bonnet Cañon, Glen, Halsey and Brady Island, Nebraska

It is an early spring form

The insect resembles *X corallipes albulus* Scudder, but averages larger and more elongate, the coloration being slightly paler and the tegminal maculations very vague and often giving a somewhat streaked appearance The caudal femora of the females are less strongly lamellate and narrow more gradually distad than in that insect, but this feature is not always as conspicuous in the male sex. The general facies leads us to believe that careful revisionary studies will prove the insect to be specifically distinct from *corallipes* and its several races

We have made a thorough study of our series of *Xanthippus* and find that Scudder's *albulus* is a geographic race of *corallipes* (Haldeman) It is known from the vicinity of Prescott, Arizona,[11] through the mountains of New Mexico to Colorado and is widely distributed over the Great Plains in that state, reaching into western Nebraska as far north as Crawford County This race, *Xanthippus corallipes albulus* Scudder, will, therefore, probably be found in extreme southern central South Dakota

Xanthippus corallipes latefasciatus Scudder

1892 *Hippiscus X[anthippus] latefasciatus* Scudder, Psyche VI, p. 359 [♂, ♀ Red River, Manitoba, Calgary, Alberta, upper Missouri and Yellowstone Rivers]

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[11] Topotypes are in the author's collection

Though very similar to *X coralhpes albulus* Scudder, this insect is clearly separable as a more northern geographic race It is a spring form, but occasional adults may survive into the fall

Rosebud, Philip, Interior, Quinn, Wall, Rapid City, Newell and Hot Springs

The adults in this series of forty-four specimens were secured between April 11 and June 29

The wing band is subject to decided variation in this insect It is best separated from *corallipes albulus* by the more robust form, with pronotal metazona broader and its lateral carinae more prominent, while the organs of flight are not, as a rule, as well developed Though having a distinctive facies, it is admittedly difficult to separate these races, as is true for practically all of the races into which *corallipes* is divided

We have reached the present conclusion only after much work, which has afforded proof that Scudder's revision of the genus is utterly unreliable Location of the older names was assumed and not carefully worked out, while in some cases the series of a supposed new species included representatives of as many as three previously described forms It is impossible to locate Saussure's Mexican species without examination of the types or large series from that country The few Mexican specimens before us indicate that it is advisable to consider Saussure's species distinct from any of the species of the central United States, as all came from far south of the northern boundary of that country With the material from the United States now at hand the first steps for a revision of *Xanthippus* have been taken, the conclusions for the forms involved in the present study here noted and sufficient evidence gathered to warrant the statement that the number of supposedly valid species will be greatly decreased

So frequently has *corallipes latefasciatus* been confused with other forms that little reliance can be put in past records Its distribution is shown by material before us to extend from Aweme, Manitoba[32] to Rudy, Saskatchewan[33], south to the Yellowstone Park[34] and Cheyenne, Wyoming,[35] and Colorado Springs, Colorado[36], east to Philip, South Dakota, and War Bonnet Cañon and

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[32] Recorded by Rehn and Hebard as *latefasciatus* and as *maculatus* and probably by Criddle as *sapotecus*

[33] Recorded by Rehn as *sapotecus*

[34] Recorded by Rehn and Hebard as *maculatus*

[35] Recorded by Scudder as *sapotecus*

[36] Recorded by Rehn and Hebard as *conspicuus*

Alliance, Nebraska The numerous Canadian records of *tigrinus* by Walker probably apply to this race, but Scudder's record of *latefasciatus* from British Columbia is probably incorrect, as was that by Buckell in 1921

Hippiscus rugosus (Scudder)

1862 *O[edipoda] rugosa* Scudder, Boston Jour Nat Hist, VII, p 469 [♂, ♀ Massachusetts, Maine]
1920 *Hippiscus rugosus* Blatchley, Orth of North-Eastern America, p 269

The established synonyms are *compactus*, *variegatus*, *suturalis* and *citrinus* of Scudder and *immaculatus* Morse

Sioux Falls, Canton, Volin, Vermilion, Springfield, Fairfax, Chamberlain, Bijou Hills, Pierre, Capa, Rosebud, Interior, Martin, Newell, Whitewood, Spearfish and Hot Springs

The one hundred and forty-three adults here recorded were taken between August 5 and September 26. This is one of the common species to appear in the fall over most of its wide distribution

The insect is usually found most abundant in grasslands of poorer soil or in old fields

It has been reported from Norway, Maine, to Jacksonville, Florida, and Mobile, Alabama, its northern limits westward being Fulton County, Indiana, Illinois, Minnesota, Sioux Falls, and Whitewood, South Dakota, and Huntley, Montana [17] Thence it occurs as far west as western Nebraska, Holly, Colorado, and Amarillo, Texas

Dissosteira carolina (Linnaeus)

1758 *G[ryllus] L[ocusta] carolinus* Linnaeus, Syst Nat, Ed X, I, p. 433 [America]
1920 *Dissosteira carolina* Morse, Proc Boston Soc Nat Hist, XXXV, p 465

Lake Poinsett, Brookings, Sioux Falls, Vermilion, Elk Point, Waubay, Hecla, Wessington Springs, Fairfax, Pierre, Capa, Rosebud, Martin, Buffalo, Newell and Hot Springs.

The fifty-five adults were secured between July 26 and October 4 The insect is, in the northern portion of its range, one of the late forms to appear adult Its habit of frequenting dusty roads, combined with the distinctively colored wings (which are black with a white border), makes it one of the most noticeable grasshoppers.

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[17] A male, taken September 2, 1924, by N Criddle at this locality, is in the author's collection

The species enjoys an unusually wide and general distribution from all but the more boreal portions of New England to northern Florida[33] and westward to the Pacific Coast Its known northern limits are the Muskoka Lakes district of Ontario, Aweme, Manitoba, Regina, Saskatchewan, Medecine Hat, Alberta, and numerous localities in southern British Columbia It has not been found, except in the mountains, south of northern New Mexico, Arizona and California

Dissosteira longipennis (Thomas)

1872 *O[edipoda] longipennis* Thomas, Ann Rept U S Geol Surv Terr, Hayden, V, p 463 [♂, Kansas]
1915 *Dissosteira longipennis* H E Smith, U S Dept of Agr, Bull No 293, pp 1 to 12

Bruner's *Oedipoda nebrascensis* is a synonym of this species

Capa, August 12, 1910, 1 ♂

This handsome species, though seeking bare areas of poor soil, unlike *D carolina* (Linnaeus), prefers the open, away from roads and habitations

The above record is the most northeastern and may be based on an individual which had migrated from its original habitat The species is widely distributed over the Great Plains in Colorado, western Nebraska, Kansas and Oklahoma, northwestern Texas, and northern New Mexico

It is usually not very abundant and is difficult to secure, as it is remarkably wary and flies very powerfully At times, however, the species appears, migrating in large numbers, when it is found in the cities, and has been reported by Bruner, at such a time, to have appeared all over Nebraska

The period of its adult appearance is probably much the same as that of *carolina*

Spharagemon bolli Scudder

1875 *Spharagemon bolli* Scudder, Proc Boston Soc Nat Hist, XVII, p 469 [♂, ♀, Dallas, Texas]
1920 *Spharagemon bolli* Blatchley Orth North-Eastern America, p 276

Scudder's variety *balteatum* is a synonym

Vermilion, Elk Point, Yankton, Wessington Springs, Mobridge, Rosebud, Rapid City, Whitewood, Englewood, State Game Lodge at 4000 feet and Hot Springs

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[33] Gainesville is apparently the southernmost point The Chokoloskee record by Rehn and Hebard is now known to be based on an incorrectly labelled specimen

The thirty-two adults at hand were taken from August 5 to September 9

This species prefers a woodland environment, where it is, as a rule, found in small numbers during the fall Individuals are usually very active

It occurs from southern Maine and Ontario to Florence and Denmark, South Carolina, Macon and Thomasville, Georgia, and Tallahassee in western Florida Westward it is known in Canada only from Aweme, Manitoba In the United States it is found north to Huron County, Michigan and in Minnesota, particularly the eastern portion, but not in North Dakota Westward it is found to the timbered tracts of eastern and northern Nebraska, the extreme southeastern portion of Kansas, and south to Mount Sheridan, Oklahoma and Bonita, Texas In the Rocky Mountains the species reappears and has been recorded from Manitou and Colorado Springs, Colorado[30]

Spharagemon equale (Say)

1825 *G[ryllus] equalis* Say, Jour Acad Nat Sci Phila, IV, p 307 [Arkansas River, Colorado]

1903 *Spharagemon aequale* Cooley, Bull 51, Montana Agr Exp Sta, p 237, pl VII, fig 1

Mobridge, Pierre, Capa, Interior, Martin, Lemmon, Bison, Wasta, Caputa, Pine Ridge, Buffalo, Newell, Nisland, Whitewood, Spearfish and Hot Springs

These one hundred and twenty-two adults were secured between July 28 and September 26 Considerably less than half are of the pale "collared" color phase

The insect is usually found in moderate numbers in grassland environment and is the largest and most powerful species of the genus

It has a very wide distribution over the grassy plains of the western United States, reaching north to Amidon, North Dakota, Walsh and Calgary, Alberta, and throughout the interior dry belt of British Columbia Eastward it has been reported from several localities in southern Minnesota as far east as Mahtomedi, as common in Iowa, and from Barber County, Kansas Southward it is known from Wichita Falls, Quanah, Clarendon and Amarillo, Texas Though we have reported *equale* from Salt Lake City, Utah, its limits of distribution in the Great Basin and southward can not yet be satisfactorily defined

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[30] The records from New Mexico by Scudder and Cockerell are all, we believe, referable to *S inornatum* Morse

Spharagemon collare (Scudder)

1872 *Oedipoda collaris* Scudder, U S Geol Surv Nebraska, Final Rept, pt 3, p 250 [♂, ♀, Nebraska City and banks of Platte River, Nebraska]
1872 *Oe[dipoda] wyomingiana* Thomas, Prelim Rept U S Geol Surv Montana and Terr, 5th Rept, p 462 [♂, ♀, eastern Wyoming]
1920 *Spharagemon wyomingianum* Blatchley, Orth of North-Eastern America, p 282

Though numerous attempts have been made to retain *wyomingianum* as a valid species or as a race of *collare*, we are convinced as to their synonymy, as first indicated by Kirby in 1910 Very large series are before us, study of which has enabled us to reach this conclusion The species has a wide distribution and is very plastic The number, if any, of recognizable geographic races into which it may be divided, can not at present be determined

Big Stone, Milbank, Lake Poinsett, Lake Albert, Lake Hendricks, Lake Oakwood, Sioux Falls, Elk Point, Waubay, Hecla, Ipswich, Mobridge, Capa, Martin, Lemmon, Wasta, Scenic, Pine Ridge, Buffalo, Newell, Spearfish, Whitewood, Englewood, State Game Lodge and Hot Springs

The one hundred and thirty-one adults here recorded were secured between July 14 and September 17 Not only is this insect usually abundant on the plains, but also in sand hill areas In the more humid portions of its distribution it usually occurs on sandy soil with comparatively poor vegetation, or in waste fields It is an alert insect and flies vigorously

In the east the distribution of *collare* extends from Brunswick, Maine, to Gainesville, Florida Its northern limits do not reach southern Ontario or northern Michigan, but westward it is found as far north as numerous localities in southern Manitoba, in Saskatchewan and as far as MacLeod, Alberta Its western limits are poorly understood, but it is known from Helena (previously unreported), Montana, Salt Lake City, Utah, and the San Bernardino Ranch, Arizona In the central portion of its distribution the Gulf of Mexico limits, on the south, the wide range of this species

Derotmema haydenii haydenii (Thomas)

1872 *O[edipoda] haydenii* Thomas, Prelim Rept U S Geol. Surv Montana and Terr, 5th Rept, p 460 [♂, ♀ Fort Fetterman, Wyoming, Colorado]
1919 [*Derotmema haydenii*] *haydenii* Rehn, Trans. Amer Ent. Soc, XLV, p 230

Established synonyms are Scudder's *cupidineum* and Saussure's *brunnerianum*.

Pierre, Capa, Interior, Pine Ridge, Rapid City, Buffalo, Newell and Nisland

This series of eighty-nine individuals was taken between August 5 and September 17 Eighteen have the discal portion of the wings red, the others have that area yellow

Rehn has found this insect to be a "race of the Great Plains region from Montana to New Mexico " Eastward it has been reported from Buford, Medora and Amidon, North Dakota, specimens are before us from Glen and Sidney, Nebraska, and Syracuse and Scott County, Kansas Its distribution northward does not reach Canada

Material from Marathon, Texas, shows intergradation with *D haydenii mesembrinum* Rehn, a race of western Texas and northern Mexico Intergradation in Wyoming occurs with *D haydenii rileyanum* (Saussure), a race of the Great Basin and Snake River regions

The insect prefers soil almost devoid of vegetation and is often found abundant, but in decidedly local colonies

Mestobregma kiowa kiowa (Thomas)

1872 *O[edipoda] kiowa* Thomas, Prelim Rept U S Geol Surv Montana and Terr, 5th Rept, p 461 [♀, Colorado, east of the mountains]
1890 *Mestobregma pulchella* Bruner, Proc U S Nat Mus, XII, p 64 [♂, ♀, Glendive and between Livingston and Gardiner, Montana]
1922 *Mestobregma kiowa* Hubbell, Occas Papers Mus Zool Univ Michigan, No 113, p 26

The type of *pulchella* in the author's collection and similar material before us, show plainly that this name was based merely on a striking chromatomorph of *kiowa* (in which the pale portions are greenish white and more extensive), unworthy of nominal recognition, which the describer found on "sweet sage, *Eurotia lanata* Pursh "

Sisseton, Waubay, Big Stone, Lake Poinsett, Lake Albert, Lake Hendricks, Lake Oakwood, Bruce, Brookings, Sioux Falls, Canton, Elk Point, Volin, Yankton, Hecla, Wessington Springs, Pierre, Chamberlain, Bijou Hills, Capa, Philip, Interior, Martin, Scenic, Pine Ridge, Lemmon, Rapid City, Fairburn, Buffalo, Castle Rock in Harding County, Newell, Spearfish, Whitewood, State Game Lodge at 4000 feet and Hot Springs

These two hundred and seventy-five adults were secured between July 6 and September 23. All have hyaline tegmina Of the present series a single male, from Newell, has the pale portions of the color pattern greenish white.

This insect is generally distributed over the Great Plains, where it usually is found in large numbers in the scanty grasses It occurs north to Manitoba, Saskatchewan, Alberta and British Columbia, being found as far north as the Okanogan Valley in the latter province Southward typical *kiowa* has been recorded from Mountain Park, Oklahoma, and Amarillo, Texas Its geographic limits can not be better defined at present, owing to the fact that, though it apparently breaks into a number of geographic races, this can not be definitely stated until much revisionary work has been done Somes' numerous records of *Mestobregma cinctum* (Thomas) from Minnesota, in 1914, are apparently partly referable to this insect and partly to the more eastern species or race, *M thomasi* Caudell

Mestobregma plattei plattei (Thomas)

1873 *O[edipoda] plattei* Thomas, Rept U S Geol Surv Terr, V, p 123 [♂, ♀, near Platte River in Colorado and Wyoming]
1919 [*Mestobregma*] *plattei plattei* Rehn, Trans Amer Ent Soc, XLV, p 238.

Wessington Springs, Mobridge, Pierre, Chamberlain, Bijou Hills, Capa, Newell and Whitewood

The forty-eight adults were captured on dates ranging from July 25 to September 11 A small percentage of the series is red-winged, the others being of the more frequently encountered yellow-winged phase This handsome insect is by no means as abundant as the preceding and is much more local in distribution

It prefers hillsides of scanty vegetation with scattered trees and, though the present race occurs in the Great Plains region, it has never been found by us on the grassy plains themselves, though liable to be present wherever their contour is broken

It is found typical from Wyoming to southern Colorado, south of that region being supplanted by *M. plattei corrugata* (Scudder), while in central and southern Arizona the race *M plattei rubripenne* (Bruner) occurs

The above South Dakotan records are the most northeastern known for the species and race, the other eastern limits being extreme southwestern Nebraska and Fairmount, Kansas

Metator pardalinus (Saussure)

1884 *Ps[inidia] pardalina* Saussure, Prodromus Oedipodiorum, p 162 [♂, ♀, Colorado]
1917 *Metator pardalinus* Beamer, Bull Univ Kansas Biol Ser, XVIII, pp 79 and 111

Saussure's variety *maculosa* has been correctly placed as a synonym

Mobridge, Capa, Buffalo, Newell, Nisland, Spearfish and Custer

This series of fifteen adults was taken between August 24 and September 26

This striking species prefers the short grass of the plains, where we have found it by no means generally present and often in small numbers, though Bruner has reported it as very common in Nebraska

It is known north to Regina, Walsh and Waldeck, Saskatchewan, and Fort MacLeod, Alberta Its eastern limits are Bismark, North Dakota (as shown by material before us), the localities listed above and the prairies of Nebraska and Kansas (the latter by inference, though not definitely stated in Beamer's paper) Southward it is known from Amarillo, Texas, as far west as Williams, Arizona

In the Great Basin and northward it is supplanted by *Metator nevadensis* (Bruner).

The sand-loving eastern *Psinidia fenestralis fenestralis* (Serville) has been reported from northwestern Nebraska by Bruner, but in our opinion, in error No material of the species from that state is to be found in the Bruner Collection, now belonging to the author The extreme northwestern limits of the insect, as far as known, are therefore recognized as eastern Iowa and southeastern Minnesota

As a result, it is unlikely that the species will be found in South Dakota, though such might have been inferred from Bruner's record

Trimerotropis gracilis (Thomas)

1872 *O[edipoda] gracilis* Thomas, Prelim Rept U S Geol Surv Montana and Terr, 5th Rept, p 461 [♂, Colorado and Wyoming]
1901 *Trimerotropis gracilis* McNeill, Proc U S Nat Mus, XXIII, p 412
1924 *Trimerotropis gracilis* Henderson, Utah Agr Exp Sta Bull, 191, (Tech), p 82

Scudder's *Derotmema lichenosum* is a synonym

Buffalo, August 26, 1924.

This record is of particular interest in carrying far eastward the definitely known distribution of *gracilis*,[40] a species widely and generally distributed through most of the sage-brush territory of the far west It is known from Chilcotin, Kamloops and Nicola, British Columbia, Salmon City, Birch Creek and Springfield, Idaho, Salt Lake Valley, Utah, Yellowstone and the northern boundary of Montana[41], Alkali Stage Station on the Green River and Douglass, Wyoming (as the synonymous *Derotmema lichenosum*) and numerous localities in the mountains of Colorado, east to Greeley, Pueblo and Alamosa, and southwest to Dolores

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[40] We believe that Bruner's record of "*Conozoa gracilis* Thos," from along the Platte River in southwestern Nebraska, was based on material of a different species

Trimerotropis cincta (Thomas)

1870 *O[edipoda] cincta* Thomas, Proc Acad Nat Sci Phila, 1870, p 80, [New Mexico]

1901 *Trimerotropis cincta* McNeill, (in part), Proc U S Nat Mus, XXIII, p. 414

Game Lodge, 4300 feet, September 7, 1923, 1 ♀. Hot Springs, August 27, 1919 to 1923, 19 ♂, 15 ♀

Though a common species, its distribution is poorly defined by the records hitherto published It is known from the Rocky Mountains of Colorado and New Mexico, from Amidon, North Dakota, and from Pine Ridge, Nebraska

The reappearance of this largely Rocky Mountain grasshopper in the Black Hills and adjacent higher country is a feature of distribution noteworthy for several other species as well

The caudal tibiae are yellowish or bluish in all of the present series, with a broad proximal annulus of slightly paler coloration, followed by a suffusion which varies from feeble to distinct

Trimerotropis bruneri McNeill

1893. *Hadrotettix gracilis* Bruner, Publ Nebraska Acad Sci, III, p 25 [West and northwest Nebraska]

1900 [*Trimerotropis*] *bruneri* McNeill, Psyche, IX, p 31 (Key, no locality given)

1901 *Trimerotropis bruneri* McNeill, Proc U S Nat Mus, XXIII, p 423 [♂, ♀ Hot Springs, South Dakota, Cheyenne, Wyoming, Chadron, Nebraska]

Mobridge, Pierre, Capa, Interior, Martin, Pine Ridge, Buffalo, Castle Rock in Harding County, Newell, Nisland, Whitewood, Spearfish, Hermosa, Fairburn, State Game Park, and Hot Springs

Though typically very distinct in general appearance, this species and *T latincincta* Saussure, in some places show considerable individual variation in marking, often leading to a strong though superficial similarity Such is true of the material here recorded from Buffalo and Newell

The two hundred and ninety-two adults at hand were taken between June 26 and September 17 It is probable, however, that the insect does not appear adult in considerable numbers until some time after the earlier date It prefers the short grass and herbage of the Great Plains, where it is usually found generally distributed and moderately numerous

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[41] Almost certainly not including Dakota, as originally given by Thomas.

Since the localities noted in the above references were recorded, the species has been reported as abundant on the northern plains of Colorado and south to La Junta, Pueblo and Antonito, in that state, as well as from Clarendon, Texas Scudder and Cockerell's record from La Cueva, Organ Mountains, New Mexico, requires verification Northward it is known from Lethbridge, Alberta, Medicine Hat and Swift Current, Saskatchewan, and east to Devil's Lake, and Amidon, North Dakota

Trimerotropis laticincta Saussure

1884 *T[rimerotropis] laticincta* Saussure, Prodromus Oedipodiorum, p 169 [♀, Texas]

1917 *Trimerotropis latifasciatus* Beamer (not of Scudder, 1880?), Bull Univ Kansas, Biol Ser, XVIII, p 121 [♂, ♀, western Kansas]

Though *laticincta* was synonymized under *T latifasciata* Scudder, by E M Walker, in 1910, we do not believe that the evidence given is at all conclusive The species represented probably divides into geographic races and even the valid number of related species is doubtful

Pierre, Chamberlain, Capa, Interior, Wasta, Pine Ridge, Buffalo, Newell and Nisland

The series of one hundred and forty-five adults was secured between August 12 and September 6

So little understood is this insect, at the present time, that we are unable to discuss its geographic limits further than to say that it is a member of a group of large and very vigorous species, generally distributed over the arid and semi-arid regions of the western United States and northern Mexico One specimen, probably representing the same species as the series here recorded, has been reported from MacLeod, Alberta, by E M Walker as *T latifasciata* Scudder, and Beamer's figures of material from western Kansas are apparently also referable to this insect.

Trimerotropis campestris McNeill.

1900 *[Trimerotropis] campestris* McNeill, Psyche, IX, p 31 (Key) [Wyoming]

1901 *Trimerotropis monticola* McNeill, (not of Saussure, 1884), Proc U S Nat Mus, XXIII, p 422 [Colorado [43]]
1901 *Trimerotropis campestris* McNeill, Ibid, p 423 [♂, ♀, Pine Bluffs, Wyoming]

The synonymy of *T longicornis* E M Walker is evident, as suggested by Buckell in 1924

Presence in the Bruner Collection, now belonging to the author, of seven male and one female topotypes of *campestris*, taken with the type which was sent to McNeill by Bruner, shows that this is the species which has subsequently been repeatedly recorded from the United States as *T monticola* Saussure That insect occurs in Mexico and New Mexico and may be readily separated from the present species by the caudal femora which, as given in the original description, have their internal surfaces black, with dorsal margin, ventral carinae and a preapical band of yellow or blood red

Mobridge, Bison, Martin, Buffalo, Pine Ridge, Whitewood, Spearfish and Hot Springs

The thirty-one adults at hand were secured between August 24 and September 10 The insect is apparently decidedly more abundant in northwestern South Dakota than elsewhere in the state

This insect not only occurs on the Great Plains but also in hilly or mountainous country, where it is usually limited to open, semi-arid, grassy spots Its distribution in South Dakota is probably very much more local than further west

The species has been recorded, incorrectly as *monticola*, from Devil's Lake, Lake Upsilon, Bottineau, Amidon and Fort Buford, North Dakota, numerous localities in southern Saskatchewan, MacLeod, Alberta, north as far as the Chilcotin District in British Columbia, from Mammoth Hot Springs and Tie Siding, Wyoming, and numerous localities on the northern plains and in the mountains of Colorado We have also examined a pair from Stockton, Manitoba, taken July 29, 1924, by N Criddle, belonging to the Canadian National Collection.

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[43] Following his key, published in the preceding year, McNeill gave the range of "*monticola*" as "Colorado into Mexico" It is evident that the material recognised as *monticola* and *campestris* by McNeill represents a single species distinct from Saussure's *monticola*, recorded by that author from Mexico and later from New Mexico We are satisfied that McNeill had before him material from Colorado, but none from Mexico

Trimerotropis agrestis McNeill

1900 [*Trimerotropis*] *agrestis* McNeill, Psyche, IX, p 32 (Key) [Nebraska]
1901 *Trimerotropis agrestis* McNeill, Proc U S Nat Mus, XXIII, p 433 [♂, ♀, Sidney, Nebraska]

Buffalo, August 26, 1924, 2 ♂, 1 ♀

Martin, September 3, 1923 and 1924, (in sand hills), 2 ♂, 6 ♀

This insect has been confused in the literature with the species generally recorded as *T citrina* Scudder, though it represents a very distinct entity The fact that *agrestis* occurs only on bare sand and is there extremely local, results in its distribution being highly discontinuous, though it is usually found in colonies of considerable size

We can give as valid only the following published records for the species Aweme, Manitoba, localities on the South Platte and Arkansas rivers in the Great Plains section of Colorado, and Sidney, Nebraska Unrecorded material before us, however, shows its distribution to be more extensive than so defined, reaching northwest to Orion, Alberta [43]

Trimerotropis salina McNeill

1900 [*Trimerotropis*] *salina* McNeill, Psyche, IX, p 33 (Key) [Nebraska]
1901 *Trimerotropis salina* McNeill, Proc U S Nat Mus., XXIII, p 436 [♂, ♀, Lincoln, Nebraska, (on salt basin)]
1922 *Trimerotropis vinculata?* Hubbell, Occas Papers Mus Zool, Univ Michigan, No 113, p 30

Newell, August 31 and September 6, 1922, 4 ♂, 3 ♀

This insect is apparently peculiar to the small, bare, saline or alkali areas occasionally found on the Great Plains and in similar environment to the east, as well as on lake borders of the same general character

The present material agrees fully with topotypes, taken with the type, in the author's collection This condition is also represented by a series from Knob Hill near Colorado Springs, Colorado, and from Clark County, Kansas It has been reported from Devil's Lake, Stump Lake, Williston and Amidon, North Dakota, and from Baldur and Ashdown, Manitoba We have also examined a pair from Orion, Alberta [44]

The insect shows close affinity to *T pallidipennis* (Burmeister)

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[43] A female, taken September 9, 1924, by N Criddle, belonging to the Canadian National Collection

[44] Taken September 9, 1924, by N Criddle, belonging to the Canadian National Collection

(of which *T. inniculata* Scudder is a synonym), but is best recognized as a distinct species until general revisionary studies have been completed.

Trimerotropis perplexa Bruner

1889 *Trimerotropis perplexa* Bruner, Proc. U. S. Nat. Mus., XII, p. 74. [♂, ♀, Bad Lands north of Chadron, Nebraska.]

1922 *Circotettix azurescens* Hubbell (not *Trimerotropis azurescens* Bruner, 1889?), Occas. Papers Mus. Zool. Univ. Michigan, No. 113, p. 34.

Buffalo, August 25 to 28, 1924, 7 ♂, 6 ♀.

Hermosa, September 2, 1924, 1 ♀.

Interior, August 29, 1922, 7 ♂, 7 ♀.

This species may prove to be a race of a more western species, which has been generally recorded as *T. azurescens* Bruner.[46] Further synonymy is involved, so that at the present time we do not feel justified in attempting to correct the name, or define the limits of distribution of the entity here under consideration.

Material from Hubbell, reported by him as *azurescens* from Medora and Amidon, North Dakota, is representative of this same condition.

Hadrotettix trifasciatus (Say)

1825 *Gryllus trifasciatus* Say, Amer. Entomology, II, pl. 34. [♂, Arkansas, three hundred miles from Rockies (= near Arkansas River in western Kansas).]

1872 *Oedipoda trifasciata* Glover, Illustr. North American Ent., Orth., pl. IX, fig. 6.

Long established synonyms are *Oedipoda pruinosa* and *hoffmanni* of Thomas.

Pierre, Chamberlain, Capa, Newell, Spearfish and Hot Springs.

This series of ninety specimens was secured between July 27 and September 29. Though active and flying powerfully, this insect is somewhat ponderous and is consequently somewhat easier to capture, as a rule, than individuals of the larger species of the genus *Trimerotropis*.

It is one of the largest and most striking Oedipodids of the Great Plains, over which it is generally distributed and moderately abundant. The above records define the northeastern boundary of its distribution, other periphereal records being as follows: Medecine Hat and Wood End, Saskatchewan, the Marias River (previously unrecorded) and Sappington, Montana, Livermore,

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[46] Under *azurescens*, in 1901, McNeill placed *perplexa* as a synonym, but without examination of the types of either, both of which are now in the author's collection.

Salida and Antonito, Colorado, San Marcial (previously unrecorded) and Silver City, New Mexico, Copper Basin and Huachuca Mountains, Arizona, Casas Grandes, Chihuahua and Coahuila, Mexico, Wichita Falls and Victoria, Texas, South McAlester, Oklahoma, Sedgwick County, Kansas, and central Nebraska Thomas' queried Ogden, Utah, record is certainly an error

Circotettix rabula nigrafasciatus Beamer

1917 *Circotettix nigrafasciata* Beamer, Bull Univ Kansas, Biol Ser XVIII, p 123, fig 108 [♂, ♀, Graham, Gove, Rooks, Logan, Trego and Barber Counties, Kansas]

1921 *Circotettix rabula nigrafasciatus* Rehn, Trans Amer Ent Soc, XLVII, p 181

Chamberlain, Capa, Interior, Martin, Wasta, Scenic, Pine Ridge, Buffalo, Deadwood, Rapid City, Fairburn, Hermosa, State Game Lodge and Hot Springs

The Chamberlain specimens are typical of this race, with solid and very broad wing band The Capa individuals are also typical, but with solid wing band not as broad All of the others, except those from the Black Hills (Deadwood, Fairburn, Hermosa, State Game Park and Hot Springs), are atypical *nigrafasciatus*, the least reduction of the wing band in these being found in the Martin specimen The Black Hills series, however, show still greater reduction and interruption of the wing band and represent atypical *rabula rabula*

Thus western South Dakota is seen to be wholly an area of intergradation between the races of the species, nearest approach to the typical northwestern race being found in the Black Hills, while immediately west of the Missouri River in south-central South Dakota the southeastern race occurs typically, invading this region from Nebraska

This series of one hundred and forty-three adults was taken from July 18 to September 26 Largest and handsomest of the races of *rabula*, *nigrafasciatus* represents one of the most striking forms of insect life on the bare slopes and precipices of mesas and hillsides, as it crackles loudly in vigorous and erratic flight over its favorite habitat.

The present material is of particular interest in showing the close agreement in coloration, at each locality, with the soil or rocks on which it was secured Thus the general coloration of the Hot Springs series is russet, of the Scenic series drab overlaid with grayish white, of the Capa series hair brown overlaid with light grayish olive and of the Chamberlain series blackish brown overlaid and marked with drab gray The optimum size development is shown by specimens from Game Lodge and Scenic

Typically this race is known from the localities in Kansas originally given, Fort Robinson, Sidney, Dismal River and Broken Bow, Nebraska, and Wray, Limon, Pueblo and Gray Creek, Colorado

Typical *rabula* is known from Glenora, British Columbia, south to northern Colorado and northern Utah, west to eastern Idaho and east to eastern Montana

A third geographic race, *C rabula altior* Rehn, is found mainly in the boreal zone of the Rocky Mountains, from northern Colorado to southern New Mexico

Aerochoreutes carlinianus carlinianus (Thomas)

1870 *O[edipoda] carliniana* Thomas, Proc Acad Nat Sci Phila, 1870, p 81 [♂, ♀, eastern Colorado]

1921 *Aerochoreutes carlinianus carlinianus* Rehn, Trans Amer Ent Soc, XLVII, p 173

Pierre, Buffalo, Newell and Whitewood

The twenty-eight adults before us were secured from July 5 to September 10 The insect is apparently uncommon in South Dakota

Not only is this insect one of the most distinctive North American grasshoppers, but its wing structure enables it to fly and stridulate most powerfully of all In the present series the general coloration is drab, with buffy brown maculations, showing little individual variation

The present is the eastern and northern race of the two into which *carlinianus* divides It occurs in the northern Great Plains and northern Rocky Mountains Typically it is known north to McLeod, Alberta, and Maple Creek, Saskatchewan Its western limits are Garrison, Montana, Hecla, Wyoming, and Gray Creek, Colorado. Eastward it is found as far as Buford, Williston and Amidon, North Dakota, and the localities listed above

The other race *A. carlinianus strepitus* Rehn, occurs typically in the Great Basin and Green River regions, atypical material occurring as far northwest as the Chilcotin District of British Columbia.

BATRACHOTETRIGINAE

Brachystola magna (Girard)

1854 *Brachypeplus magnus* Girard, in Marcy, Expl Red River of Louisiana, p 231, Zool pl XV, figs 1 to 4 [[♀, near the Red River, southwestern Oklahoma]]

1906 *Brachystola magna* Rehn and Hebard, Proc Acad Nat Sci Phila 1906, p 398

Capa, August 7 to September, 1917 and 1919, 10 ♂, 15 ♀, 2 juv ♂, 2 juv ♀

Philip, August 30, 1919, 1 ♂, 1 ♀

This is one of the largest and most striking species of the Great Plains, over which it is generally distributed and moderately numerous Though very powerfully built, the insect is extremely awkward and individuals when pursued can almost always be secured, though making violent efforts to escape

Its distribution is extended through the open grasslands from South Dakota to eastern Wyoming, the main Rockies acting as a barrier westward, though in New Mexico it reaches Santa Fé and the western side of the Organ Mountains Its known eastern limits are Philip, South Dakota, Crawford County, Iowa, Reno and Barber Counties, Kansas, Cache, Oklahoma, and Wichita Falls, Texas Southward it invades the state of Chihuahua, Mexico, there having been reported from Casas Grandes

CYRTACANTHACRINAE

Paropomala wyomingensis (Thomas)

1871 *Mesops wyomingensis* Thomas, Rept U S Geol Surv Montana, p 152 [♂, ♀, Cottonwood Creek, west base of Black Hills of Wyoming]

The synonymy of *Mesops cylindricus* Bruner was established by Rehn and Hebard in 1906, at which time the genus was correctly removed from the Acridinae to the present subfamily (then recognized as the Locustinae)

Martin, September 3, 1923, (in sand hills), 5 ♂, 5 ♀

All of this series are brown except one female, in which the caudal limbs are green, the pronotum and apex of the abdomen also being tinged with this color

The species has also been recorded from Valentine, Stratton and Haigler, Nebraska, and in Colorado along the South Platte west to Fort Collins and up the Arkansas as far as Rocky Ford It is probably common over a large portion of the Great Plains, appearing adult in early July Gillette tells us that its chief food plant in Colorado seems to be bluegrass, *Andropogon glaucum.*

Schistocerca lineata Scudder

1899 *Schistocerca lineata* Scudder, Proc Amer Acad Arts and Sci, XXXIV, p 465 [♂, ♀, Barber County, Kansas [46]]
1904 *Schistocerca lineata* Gillette, Agr Exp Sta Colorado Agr Coll, Bull 94, (Tech Ser No 6), p 38

Canton, Vermilion, Elk Point, Volin, Yankton, Springfield, Chamberlain, Mobridge, Capa, Rosebud, Martin, Wasta and Hermosa

The thirty-four adults here recorded were secured between August 6 and September 12 The species prefers to live near and among trees on water courses Though usually light and dark brown, occasional individuals are more yellowish in the paler areas, with medio-longitudinal dorsal streak bright yellow The caudal tibiae are immaculate dorsad, varying through a condition in which transverse bands are vaguely indicated to one in which such bands are decided, though not broad All here recorded have the caudal tibiae largely bluish black, except the three from Yankton, in which these members are red

A large unreported series shows convincingly that all of the color differences noted above have neither specific or geographic significance in the present case

This insect has often been recorded from the middle west as *alutacea*, *rubiginosa*, *obscura* or even *albolineata* Its nearest relationship is with *alutacea*, of which *rubiginosa* is a color phase, showing, in some portions of its range only, structural difference which elsewhere is not constant [47] We have associated the name *obscura* with a species closely related to *alutacea* but apparently quite distinct, which is as yet definitely known only from the Coastal Plain of the southeastern United States Thomas' *albolineata* is, however, a very different species, found in the United States only in southern Arizona Scudder, Bruner and Gillette have not placed that name correctly, the former describing a synonym, *S mexicana*, as a result Gillette used the name *albolineata* incorrectly for Coloradan material of *lineata* having red caudal tibiae

In summing up, we note that a single species of *Schistocerca* is known in South Dakota, unquestionably the same as Scudder's type of *lineata* Though apparently distinct, its exact relationship to the eastern *alutacea* can not be determined until a general generic revision can be undertaken It is individually variable to such an extent that past authors have recorded it under several names, and past records, of themselves, can consequently not be trusted From material before us we know *lineata* to be widely distributed over South Dakota, Nebraska, Kansas, eastern Colorado and northwestward as far as the Marias River in Montana and Medecine Hat, Alberta (recorded as *alutacea*)[48] Generic revision is needed before its eastern and southern limits can be defined

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[46] Selection of a single type has fixed this as the type locality The original Texan records may be based on an optimum, richly colored phase of the species, but that from Mexico probably represents a distinct species

[47] See Rehn and Hebard, Proc Acad Nat. Sci. Phila, 1916, p 196, (1916)

Hypochlora alba (Dodge)

1876 *Pezotettix alba* Dodge, Canadian Ent, VIII, p 10 [♂, ♀, Glencoe, Dodge County, Nebraska]
1897 *Hypochlora alba* Scudder, Proc U S Nat Mus, XX, p 47

Lake Albert, Brookings, Canton, Bijou Hills, Capa, Philip, Scenic, Rapid City, Castle Rock in Harding County, State Game Lodge and Hot Springs

Of the thirty-nine adults here recorded, taken from August 7 to September 26, five are gray or grayish, the others light green The species is normally brachypterous, with short lanceolate tegmina, but two females of the present series have fully developed organs of flight

The insect has a wide distribution over the Great Plains and adjacent regions, but is easily overlooked as it is small and inconspicuous and is only found on or near hoary sage, *Artemisia cana* Pursh

Its distribution is limited westward by the Rocky Mountains, extending from Columbus[49] Montana to north-central Texas The northern and eastern limits are Goodlands, Manitoba, southern North Dakota, extreme western Minnesota and Iowa and eastern Kansas and Oklahoma

Campylacantha olivacea olivacea (Scudder)

1875 *Pezotettix olivacea* Scudder, Proc Boston Soc Nat. Hist, XVII, p 472 [♂, ♀, Dallas, Texas]
1897 *Campylacantha olivacea* Scudder, Proc U S Nat Mus, XX, p 51

Martin, September 3, 1923, (in sand hills), 4 ♂, 4 ♀

These specimens are all green and brachypterous[50] A gray color phase, often developed, largely led to the description of *acutipennis* by Scudder, a name synonymised by Morse in 1907

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[48] Two males and a female, taken September 1, 1924, by N Criddle.

[49] A pair in the author's collection was taken at this locality, September 1, 1924 by N Criddle

[50] The normal condition for this race

In western Kansas, the Pan Handle and west of Cisco and Flatonia, Texas, this insect is supplanted by more western races Martin is the northernmost record, the race being abundant in southeastern Nebraska, all but the western border of Kansas and Oklahoma and eastern central and eastern Texas. Eastward its distribution is much less general, but it is known to us from Bedford, Sargent's Bluff, Council Bluffs and Hamburg, Iowa, Mountain Grove, Cedar Gap and Koshkonong, Missouri, Havana and Clay County, Illinois, College Station and Picayune, Mississippi, Selma and Montgomery, Alabama, and Macon, Georgia

The species prefers weedy areas, where it is usually found locally in moderate numbers

Aeoloplus turnbulli plagosus (Scudder)

1876 *Pezotettix plagosus* Scudder, Ann Rept Chief Engineers, 1876, p 504 [♂, ♀, northern New Mexico]
1897 *Aeoloplus plagosus* Scudder, Proc U S Nat Mus, XX, p 76

Pierre, August 5, 1919, 1 ♂ Capa, August 7 to September 11, 1917 and 1919, 12 ♂, 12 ♀

This is Scudder's *Aeoloplus regalis* (not *Caloptenus regalis* Dodge) and Caudell's *Aeoloplus bruneri*, proposed for that insect, consequently falls as a synonym

The present race occurs abundantly over the Great Plains in eastern Colorado, extending south to the plains of northeastern New Mexico, southeast to Wichita Falls, Texas, and east to extreme southwestern Nebraska and "everywhere" in Kansas

Intergradation between *turnbulli plagosus* and the northwestern *turnbulli turnbulli* probably occurs in western central South Dakota, north central Nebraska and southeastern Wyoming

The insect lives in and feeds on weeds and is very active. Gillette states that, in Colorado, its chief food plants are *Atriplex* sps and the Russian Thistle

Aeoloplus turnbulli turnbulli (Thomas)

1872 *C[aloptenus] turnbulli* Thomas, Ann Rept U S Geol Surv Terr, V, p. 452 [♂, ♀, between Red Buttes and Independence Rock [on the Sweetwater River], Wyoming]
1897 *Aeoloplus turnbulli* Scudder, Proc U S Nat Mus, XX, p 75

Interior, August 28, 1922, 1 ♂. Buffalo, August 27, 1924, 1 ♂, 1 ♀.

These specimens show slight variation toward *turnbulli plagosus* The present race is known typically from the Yellowstone River, Montana, southward through northeastern Wyoming as far as the plains on the lower course of the Sweetwater River and eastward to the localities given above and Gordon, Nebraska

Hesperotettix viridis (Thomas)

1872 *C[aloptenus] viridis* Thomas, Ann Rept U S Geol. Surv. Terr, V, p 450 [♂, ♀, Colorado, Wyoming and Kansas]
1897 *Hesperotettix viridis* Scudder, Proc U S Nat Mus, XX, p 57

Pine Ridge, September 2, 1924, 1 ♂, 4 ♀ Newell, September 6, 1922, 1 ♀ Hot Springs, July 8 to September 7, 1916 and 1922, 3 ♂, 7 ♀

These records represent the northeastern limit of the species, its northwestern limit being shown by a specimen before us from Helena, Montana. Westward it occurs through eastern Colorado up to 7000 feet in the Rocky Mountains, but in New Mexico we have correctly recorded material from as far west as Chaves and Deming [51] Eastward it has been reported from Sidney, Nebraska[52], Douglas and Crawford Counties, Kansas, and Dallas and San Antonio, Texas, and is known to occur to the Mexican line in that state and New Mexico

Hesperotettix brevipennis pratensis [Scudder]

1897 *Hesperotettix pratensis* Scudder, Proc U S Nat Mus, XX, p 64, pl V, fig 3 [♀, Dallas, Texas [53]]
1914 *Hesperotettix pratensis* Somes, Univ. Minnesota, Agr Exp Sta, Bull 141, Tech, p 70

Volin, Yankton, Chamberlain, Bijou Hills, Capa, Martin, Newell, Whitewood, Spearfish and Hot Springs

The series of thirty-three adults was taken between July 14 and September 17

This very handsome species occurs as far east as Lake County, Indiana, Clarksville, Tennessee, and Live Oak, Florida It apparently intergrades with typical *brevipennis* (Thomas) in the mountains of the southeastern United States Its known northern limits are Waukegan and Chautauqua, Illinois, Albert Lee, Redwood Falls and Fergus Falls, Minnesota, and the Turtle Mountains and Williston, North Dakota Other dependable records are Lake

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[51] All records from further westward are doubtful Confusion there is very likely to occur with the very similar *H viridis* Scudder That insect and other forms of the far west may represent several species, races or mere color variants of one species

[52] We can not recognize as valid Bruner's records of Minnesota and Iowa, nor his assertion that *viridis* occurs everywhere on the prairies of Nebraska and Kansas

[53] Single type selected from this locality by Rehn and Hebard in 1912 The original series included material of other species.

County and Wyandotte, Indiana, Ames, Iowa, Kimball and Stratton, Nebraska, many counties in Kansas, Caddo, South McAlester and Wilburton, Oklahoma, and Denison, Texas, while Gillette reports it as fairly common though not abundant over the Plains and foothills of eastern Colorado

It is evident from the above that this species enjoys a very wide distribution, the western limits of which can not be safely given as yet, as we do not feel justified in recognizing material from west of the Rocky Mountains as the same species Complete generic revision must be accomplished before the western forms of *Hesperotettix* can be correctly placed

Hesperotettix speciosus (Scudder)

1871 *Pezotettix speciosa* Scudder, U S Geol Surv Nebraska, Final Rept, p 250 [♂, ♀, Nebraska City and banks of Platte River, Nebraska]
1920 *Hesperotettix speciosus* Blatchley, Orth of North-Eastern America, p 335

Pierre, August 5, 1919, 2 ♂, 1 ♀ Capa, August 7 to September 11, 1917 and 1919, 12 ♂, 15 ♀

This handsome insect is the only western species which can be separated at a glance from any of the other forms of *Hesperotettix* Nearest relationship is shown to the Floridian *H floridensis* Morse

Its known limits of distribution eastward are Mahotmedi, Minnesota, Muscatine County, Iowa, Havana, Illinois, Foss, Cache and Caddo, Oklahoma, and Dallas, Texas, in that state probably extending due south to the Gulf Coast, which forms its southern limit Northward its limits are poorly understood, as there are no definite previously published records from Wyoming and Montana, in both of which states it occurs, as we have material from as far northwestward as Helena, Montana Westward in Colorado it is limited by the Rocky Mountains, but reaches up to 6000 feet in the foothills Southward its limit westward is probably the same in New Mexico, though there are no definite records from that state and the westernmost in Texas is from the Pecos River

The species prefers a weedy plains environment of sunflower and other such plants We can hardly give credence to its ever being economically harmful to a degree worthy of notice.

Melanoplus scudderi scudderi (Uhler)

1864. *P[ezotettix] scudderi* Uhler, Proc Ent Soc Phila, II, p 555 [♂, ♀ Baltimore, Maryland, Rock Island, Illinois]
1920. *Melanoplus scudderi* Morse, Proc Boston Soc Nat Hist., XXXV, p 520.

Canton, Elk Point, Yankton and Springfield

This series of thirty adults, defining the northwestern limit of the species, was taken between August 8 and October 22

This is an eastern form of wide distribution, ranging on the Atlantic coast from southern Massachusetts to Monticello, Florida Its western limits of distribution are Springfield, South Dakota, eastern Nebraska, Brown County, Kansas, South McAlester and Caddo, Oklahoma, and Myra, Texas. Westward from Lawrence, Kansas, to Bonita, Texas, a race, *M scudderi latus* Morse, occurs Southward in Texas another race, *M scudderi texensis* Hart, is found

Melanoplus discolor (Scudder)

1879 *Pezotettix discolor* Scudder, Proc Boston Soc Nat Hist, XX, p 81 [♂, ♀, Dallas, Texas.]
1897 *Melanoplus simplex* Scudder, Proc U S Nat Mus, XX, p 150, pl X, fig 8 [♂, ♀, Colorado at 5500 feet]

The synonymy of *M inornatus* Scudder, described from Monclova, Coahuila, Mexico, was established in 1917 [54] Comparison of the originally described material of *discolor* and *simplex* shows that the latter name was based on material slightly smaller and darker than the Texan series, but that such difference is merely a response to a more boreal environment and there is nothing to warrant nominal recognition of any kind

Capa, August 13 to 25, 1919 and 1922, 8 ♂, 6 ♀

This species occurs locally among the low plants and grasses of the plains Its distribution is known to be very extensive, extending from Monclova, Coahuila, Mexico, northeastward to Dallas, Texas, Clark, Osborn and Grant Counties, Kansas, and Capa, South Dakota Its western limits are Amarillo, Texas and Holly, Colorado [55] Though the species will undoubtedly be found in western Nebraska, it is not represented in the Bruner Collection

Melanoplus dodgei huroni Blatchley

1898 *Melanoplus huroni* Blatchley, Psyche, VIII, p 195 [♂, ♀, La Salle Island, Les Cheneaux Islands, Michigan.]
1920 *Melanoplus dodgei huroni* Blatchley, Orth of North-Eastern America, p 407

Whitewood, Deadwood, Englewood, State Game Lodge and Sylvan Lake

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[54] Hebard, Proc Acad Nat Sci Phila, 1917, p 268

[55] Gillette recorded a male from this locality as *simplex*, at the same time incorrectly recording as this species a male of *M glaucipes* (Scudder) from Nepesta, Colorado

These seventeen adults were taken from June 26 to September 10.

The present race, since its description, has only been reported from Pequaming and Isle Royale, Michigan, Nipigon and Fort William, Ontario, and the Chilcotin District of British Columbia. Scudder's records of *M altitudinum* (Scudder) from Englewood, Custer and Harney's Peak, South Dakota, and Fort McKinney and Sheridan,[56] Wyoming, are seen, from the material, to represent *dodgei huroni*, while it is certain that those from Montana and Fort Ellis, Montana, do likewise, as material is before us from the West Gallatin Canyon and Mystic Lake, Montana [57] The same is true of Scudder's record of material from Pine Ridge, Nebraska, sent him by Bruner (to which the nomen nudum *Pezotettix sanguinipes* Bruner applies), though now not represented in either the Scudder or Bruner Collections Additional material is before us from Tower and Cass Lake, Minnesota, and Shaftsbury, Alberta

The species is boreal and this, the optimum northern race, prefers a sylvan habitat In the southern Rocky Mountains *dodgei huroni* is replaced by other races

The insect is known in South Dakota only from the Black Hills In North Dakota it will probably be found very locally distributed in hilly wooded areas, though it was not encountered in that state by Hubbell

Melanoplus differentialis (Thomas)

1865 *Acridium differentiale* Thomas, Trans Illinois State Agr Soc, V, p 450 [♂, ♀, Illinois]

1920 *Melanoplus differentialis* Blatchley, Orth of North-Eastern America, p 440

Brookings, Yankton, Chamberlain, Pierre and Capa

These thirty-three adults were taken between August 17 and October 27 Fourteen are black with a few yellow markings, a striking color phase apparently only developed on the Great Plains and adjacent regions

The insect is larger than *M bivittatus* (Say), and probably does even greater damage to crops over the wide extent of country in which it is very abundant. Away from cultivation it is often rather scarce, but in rank patches of weeds on disturbed ground it is frequently to be found in very great numbers

The eastern limits of its native distribution, as published, are eastern Indiana, Nortonville and Hopkinsville, Kentucky, and Chattanooga, Tennessee On the Atlantic Coast it is known only from Staten Island, New York, Philadelphia, Pennsylvania, and adjacent New Jersey and Dennisville, New Jersey, apparently having been introduced The northern limits are Douglas Lake in Cheboygan County, Michigan, Madison, Wisconsin (previously unpublished), Valley of the Minnesota River, Minnesota, Brookings and Pierre, South Dakota, and Cheyenne, Wyoming It is apparently largely absent from the Great Basin, but occurs as far west as Grand Junction, Colorado and Albuquerque, New Mexico In eastern Colorado it is very abundant and destructive, particularly in the more humid areas Westward it reappears, being known from Lincoln County, Nevada, Phoenix, Arizona, and Agua Caliente in Sonoma County, the San Joaquin Valley, Claremont and Los Angeles, California Its known limits southward are Chattanooga, Tennessee, Agricultural College, Mississippi, Tallulah, Louisiana[58], Gulf Coast of Texas, and in Mexico from Vera Cruz, Queretero and Guadalajara in Jalisco

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[56] Property of the Illinois State Lab Nat. Hist.

[57] It is equally certain that Scudder's records of *altitudinum* from southern Colorado and northern New Mexico are not referable to *dodgei huroni*.

Melanoplus bivittatus (Say)

1825 *G[ryllus] bivittatus* Say, Jour Acad Nat Sci Phila, IV, p 308 ["Arkansa" (Arkansas River, near the Rocky Mountains, Colorado)]

1838 *Caloptenus femoratus* Burmeister, Handb Ent, II, Abth II, Pt I, p 638 [♂, Carolina]

1920. *Melanoplus bivittatus* Blatchley, Orth of North-Eastern America, p 449

Though material with red caudal femora has persistently been recognized as *M femoratus*, we believe that Kirby, E M Walker, Somes and Blatchley are correct in placing that name as a synonym of *bivittatus* In the east, and also in the Sierra Nevada Mountains of the far west, individuals apparently invariably have rich red caudal tibiae, but this indicates rather a response to humidity and possibly other environmental factors than any specific or racial differentiation. Other established synonyms are *milberti* (Serville), *flavovittatus* (Harris), *edax* (Saussure) and *rejecta* (F Walker)

Brookings, Chamberlain, Capa, Lemmon, Newell, Lead, Sylvan Lake and Hot Springs

The forty-six adults before us were secured between July 12 and October 9. All have yellowish caudal tibiae, suffused to different degrees and extent dorso-proximad with bluish black One female from Hot Springs is very unusual in having the tegmina perfectly formed but covering little more than half the abdomen, the wings somewhat malformed

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[58] A previously unrecorded specimen in the National Museum, taken November 10, 1909, by H Pinkus

This insect occurs everywhere in the United States except the southeastern portion and is extremely local in all the semi-arid regions of the west, there often confined to irregated areas In California it is extremely scarce or absent except in the northern portions of the state and in the high Sierran Valleys Northward its known limits are Port-aux-Basques, Newfoundland, Quebec, Hudson Bay, southern Manitoba, Saskatchewan and Alberta, to Quesnel, British Columbia Southward it is known as far as Lerdo, Durango, Mexico

Melanoplus dawsoni (Scudder)

1875 *Pezotettix dawsoni* Scudder, Dawson's Rept Geol 49th Parallel, p 343 [♂, ♀, Souris River, southwestern Manitoba.]
1899 *Melanoplus acutus* Scudder, Proc Davenport Acad Nat Sci, VII, p 171 [♂, ♀, Brown's Valley, Minnesota]

The single type of *acutus*, a male, selected by Rehn and Hebard in 1912, has been examined and found to be typical of *dawsoni* This error is solely attributable to carelessness on the part of the describer

The names *tellustris* (Scudder), *abditus* (Dodge) and *dawsoni completus* Scudder, have been previously correctly referred to the present synonymy

Sisseton, Big Stone, White, Lake Hendricks, Brookings, Hecla, Waubay, Yankton, Wessington Springs, Mobridge, Pierre, Capa, Rosebud, Philip, Lemmon, Bison, Buffalo, Rapid City, Whitewood, Spearfish, State Game Park, Sylvan Lake and Hot Springs

The series of one hundred and sixty-one adults was secured from July 12 to October 4 The species is normally brachypterous, sixteen specimens of the present series being fully macropterous

This insect is widely distributed and abundant over the plains and foothills of the northwest Its known limits of continuous distribution northward are southern Manitoba, Saskatchewan and Alberta to Kaslo, British Columbia Westward it is apparently bounded by the Rocky Mountains, there reaching as far southward as northern New Mexico [59] Its known southern limits are Fort

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[59] In Colorado it is found only in the eastern foothills of the Rocky Mountains, in that state being recorded as far south as Palmer Lake

Robinson and Lincoln, Nebraska, Hamburg and Elmira, Iowa,[60] and Lone Rock, Wisconsin (previously unpublished)

East of Minnesota and Iowa the species is extremely unusual in having a very wide but highly discontinuous distribution The eastern records are Pequaming[61] and Saginaw Bay, Michigan, Tobyhanna, Pennsylvania[61], Toronto, Ontario, Manchester, New Hampshire, and Brunswick, Maine

Melanoplus gladstoni Scudder

1897 *Melanoplus gladstoni* Scudder, Proc U S Nat Mus, XX, p 229, pl I, fig b, pl XV, fig 6 [♂, ♀ Medecine Hat, Alberta[62], Montana, Gordon and Fort Robinson, Nebraska, Custer County, Colorado]

1897 *Melanoplus conspersus* Scudder, Proc U S Nat Mus, XX, p 315, pl XXI fig 5 [♂, ♀, southwest Nebraska]

1897 *Melanoplus compactus* Scudder, Proc U S Nat Mus, XX, p 316, pl XXI, fig 6 [♂, ♀ Dakota, Gordon, Nebraska]

Northward and eastward this species shows depauperation, and on such smaller individuals *gladstoni* was based In the Rockies material from higher elevations shows similar depauperation Apparently through adherence to his key, Scudder failed to note the exact similarity in all other respects of the larger specimens which he described as *conspersus* Comparison of the single types of *gladstoni* and *conspersus* shows no feature on which even racial recognition could be given to the latter name [63] The single type of *compactus* differs from that of *conspersus*, as Scudder stated, only in the narrower subgenital plate and broader interspace between the mesosternal lobes. The former feature is of slight degree and both are clearly attributable to individual variation Large series before us show that the width between the mesosternal lobes varies in this and in several other species of the genus, where Scudder supposed it to have significance as a specific character.

From examination of the types of *M. corpulentus* Scudder and *M bicoloratus* Scudder it is plain that these are very closely related, possibly southwestern geographic races or phases of *gladstoni*, whose exact status can not be determined without detailed comparisons of large series

Big Stone, Lake Oakwood, Lake Albert, Brookings, Sioux Falls, Canton, Waubay, Volin, Yankton, Hecla, Springfield,

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[60] These Iowa records are based on previously unstudied material before us

[61] Based on material collected by the author but previously unpublished

[62] Male, single type selected from this locality in 1912 by Rehn and Hebard, for *conspersus* the male, and for *compactus* the Dakota male

[63] This synonymy was first indicated by Walker in 1910

Chamberlain Bijou Hills, Pierre, Capa, Mobridge, Rosebud, Philip, Interior, Martin, Lemmon, Bison, Buffalo, Castle Rock in Harding County, Caputa Rapid City, Fairburn, Newell, Nisland, Whitewood, Spearfish, Sylvan Lake and Hot Springs

The two hundred and eleven adults were secured between August 14 and October 28

A vigorous and active species, this insect is usually abundant in its favorite grassland environment, over which it is usually very generally distributed

The area covered by this insect includes a wide extent of the northern plains, limited westward by the high divides of the Rocky Mountains Its northern limits are southern Manitoba and Saskatchewan to Banff, Alberta In Colorado it covers the eastern plains and reaches up to 8500 feet in the eastern Rockies Eastward it is known from Devil's Lake and Amidon, North Dakota (as *conspersus*), Fergus Falls, Granite Falls and Pipestone, Minnesota[64], northwestern Iowa (as *conspersus*), the high prairies of western Nebraska (as *conspersus*), and Sherman County, Kansas (as *conspersus*)

Southward and southwestward it is replaced by *corpulentus* and *bicoloratus*, whose status, as noted above, is uncertain

Melanoplus confusus Scudder

1897 *Melanoplus confusus* Scudder, Proc U S , Nat Mus XX, p 339, pl XXII, fig 10 [♂, ♀, Munson s Hill, Kentucky]
1920 *Melanoplus confusus* Morse, Proc Boston Soc Nat Hist , XXXV, p 507

The names *M minor* (Scudder) and *M mutatus* Caudell were placed in the present synonymy in 1916 by Rehn and Hebard, the species having previously been generally recorded as *minor*

Lake Hendricks, Garretson, Canton, Yankton, Springfield, Rosebud, Philip, Martin, Rapid City, Pine Ridge, Newell, Whitewood and Hot Springs

The species has also been recorded from Harney's Peak in the Black Hills, at an elevation of 7000 to 8000 feet

These fifty-four adults were secured between June 16 and August 27. The caudal femora are glaucous in all of the males and the majority of the females, but in eight of the latter sex they are pink. The insect is a spring form, though occasionally adults survive until late fall

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[64] *Somes' record of conspersus* from Mahtomedi, Minnesota, appears questionable

The species prefers grassy areas in the open and is locally often moderately abundant As it appears earlier than most grasshoppers and is local in distribution, it is much less apt to be secured by the collector than many species which are actually less common.

It ranges from the Atlantic to the Pacific The northern known limits are northern New England, Toronto, Ontario; Winnipeg and Aweme, Manitoba, Rudy, Saskatchewan, and the Chilcotin District of British Columbia. Its southern limits, as published, are Fredericksburg, Virginia, Havelock, North Carolina, Monroe County, Indiana, Missouri[65], Clark County, Kansas, Pueblo, Colorado, Pecos, New Mexico, and Prescott, Arizona On the eastern slope of the Rocky Mountains it reaches up to 7000 feet, but it is not known west of these mountains between northern New Mexico and Washington

Melanoplus femur-rubrum femur-rubrum (DeGeer)

1773 *Acrydium femur-rubrum* DeGeer, Mém l'Hist Nat Ins, III, p 498, pl 42, fig 5 [♂, Pennsylvania]

1920 *Melanoplus femur-rubrum* Blatchley, Orth of North-Eastern America, p 420.

Scudder established the synonyms *erythropus* (Gmelin), *femorale* (Olivier), *devorator* (Scudder), *sanguinolentus* (Provancher) and *interior* Scudder, Caudell his own *coloradus*, and Rehn and Hebard Dodge's *plumbeus* The latter is a striking color phase, showing greatest brilliancy in the humid spots of the Great Plains region Though found only on the plains and prairies of the middle west, in such environment all gradations to the normal occur and nominal recognition is clearly not justified

Sisseton, Big Stone, Lake Hendricks, Lake Albert, Lake Oakwood, Lake Poinsett, Brookings, Wentworth, Colton, Sioux Falls, Yankton, Springfield, Wessington Springs, Fairfax, Chamberlain, Mobridge, Pierre, Capa, Interior, Martin, Lemmon, Wasta, Buffalo, Caputa, Rapid City, Newell, Nisland, Whitewood, Englewood, State Game Park and Hot Springs

The three hundred and fifty-five adults were taken from August 1 to October 28. In two depauperate males from Newell, the tegmina and wings fail to reach the base of the supra-anal plate, but are distorted and show abnormality rather than brachypterism.

This is an ubiquitous species in weeds and grasses, particularly in and about cultivation. Though usually abundant and probably doing much damage in the aggregate, it never appears in multitudes which cause immediate concern as do such forms as *M mexicanus atlanis* (Riley) The insect is apparently wholly unable to survive in an arid environment, but wherever moisture appears or irrigation is undertaken, even in the areas of maximum normal aridity, it is almost sure to be found

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[65] Material from Mountain Grove, Missouri, is in the author's collection

Normally having pink caudal tibiae, a pair of distinctly plumbeus coloration have glaucous caudal tibiae, the shade being greenish in the male The plumbeus color phase is frequent in the southern part of the state A few from Pierre and Capa are richly plumbeus and yellow, though not as brilliant as material before us from Haigler, Nebraska

The species occurs over the entire United States, in the arid sections confined to watered areas In the southeastern United States the typical race is supplanted by *M femur-rubrum propinquus* Scudder Northward typical *femur-rubrum* is found from Halifax, Nova Scotia, to the Chilcotin District in British Columbia, and southward in Mexico to Atoyac, Vera Cruz The records of its occurrence in arctic America are probably incorrect

Melanoplus infantilis Scudder

1879 *Melanoplus infantilis* Scudder, Proc Boston Soc Nat Hist , XX, p 65 [♂, ♀ South Park and Florissant Colorado, Evanston, Wyoming]
1897 *Melanoplus infantilis* Scudder, Proc U S Nat Mus , XX, p 335

Big Stone, Brookings, Mobridge, Pierre, Capa, Martin, Lemmon, Bison, Buffalo, Castle Rock in Harding County, Newell, Nisland, Whitewood and Spearfish

The twenty-nine adults were secured between August 14 and October 26 Smallest of the macropterous species of *Melanoplus*, this insect is easily overlooked It usually occurs in moderate numbers in the short sparse grasses of the plains and hills In South Dakota, however, it is probably scarce except in the northwestern portion, as it is a form of the more northern plains, reaching, in this region, close to its eastern limits of distribution

The species is known northward to southern Manitoba, Saskatchewan, Alberta and the Chilcotin District in British Columbia Westward it invades the Rockies up to 8000 feet, as far southwest as Durango, Colorado, but northward it is found west of these mountains, having been reported from Evanston, Wyoming, Salmon City, Idaho, Ellensburg, Washington, and several localities in southern British Columbia Southward it is known from

Durango, Alder and Pueblo, Colorado, and Kimball, Nebraska East from the latter locality, Fergus Falls and Detroit, Minnesota, and Stump Lake and the Turtle Mountains, North Dakota

Melanoplus kennicottii Scudder

1878 *M[elanoplus] kennicottii* Scudder, Proc Boston Soc Nat Hist, XIX, p 289 [♂, Yukon River,[66] Alaska]
1897 *Melanoplus kennicottii* Scudder, Proc U S Nat Mus, XX, p 163

Buffalo, August 25 and 26, 1924, 4 ♀

This is one of the scarcer boreal species Since the original description it has been recorded from Mt Rundle near Banff, Alberta, Rudy and the Souris River, Saskatchewan, Glendive and Custer County, Montana, Ward and the Marshall Pass, Colorado (at 10000 to 11000 feet), and Chama, New Mexico (at 7863 feet)

Its known distribution is therefore carried far southeast by the above record and it will probably be found over the high plains of Montana and Wyoming [67]

Melanoplus lakinus (Scudder)

1879 *Pezotettix lakinus* Scudder, Proc Boston Soc Nat Hist, XX, p 79 [♂, ♀ Lakin, Kansas, Pueblo, Colorado]
1897 *Melanoplus lakinus* Scudder, Proc U S Nat Mus, XX, p 141

The synonymy of *marculentus* Scudder and *sonorae* Scudder was established by the author in 1917

Capa, August 7 to September 11, 1917 to 1922, 26 ♂, 22 ♀

All of the present series have short lanceolate tegmina except three males, in two of these the tegmina half cover the abdomen, the other has fully developed organs of flight

This insect is a grassland inhabitant, often preferring areas of herbaceous plants and frequently encountered very abundant and generally distributed

The above record extends the known range of this species considerably to the northeastward. Its previously known eastern limits were the Republican River in southwestern Nebraska, all of Kansas, Amarillo, Texas, and Las Vegas and Mescalero, New Mexico. It is known as far north as the northern boundary of Colorado, being limited westward by the foothills of the Rocky Mountains, but southward spreading west to Carr Canyon in the

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[66] "Yukon River, south of which the mountains trend westward " Probably between Kaltag and Nulato

[67] Material is before us from Casper, Wyoming

Huachuca Mountains, Arizona It has a wide distribution in Mexico, from Sonora and Tamaulipas south to Aguascalientes

Melanoplus occidentalis occidentalis (Thomas)

1872 *C[aloptenus] occidentalis* Thomas, Prelim Rept U S Geol Surv Montana and Terr, V, p 453, pl II, fig 2 [♂, ♀, mouth of Laramie River to Red Butte, eastern Wyoming]

1879 *Melanoplus flabellifer* Scudder, Proc Boston Soc Nat Hist, XX, p 69 [♂, South Park, Colorado, (8000 to 10000 feet)]

1897 *Melanoplus occidentalis* Scudder, Proc U S Nat Mus, XX, p 145

1897 *Melanoplus cuneatus* Scudder, Proc U S Nat Mus XX, p 147, pl X, fig 5 [♂ Silver City, New Mexico, Fort Grant and Fort Whipple, Arizona]

After careful consideration of the types and large series now available, it is clear that both *flabellifer* and *cuneatus* are synonyms of *occidentalis* The male cerci show some individual variation in outline, as does the subgenital plate, and upon such features alone Scudder based those names

Philip, Rapid City, Pine Ridge, Smithwick, Newell, Nisland, Spearfish and Hot Springs

The forty-nine individuals were secured from June 23 to September 17, the majority having been taken in June All of the material from South Dakota is depauperate for the species.

Its distribution eastward is defined by Amidon, North Dakota, Ottertail County, Minnesota, middle Nebraska, and numerous localities in Kansas Northwestward in the United States it is known as far as Emigrant, Montana, but it is also known from Lethbridge, Alberta, and reappears abundantly in the Chilcotin District of British Columbia Southward it is known from the plains of Wyoming and Colorado and the Rocky Mountains up to 10500 feet, south to Antonito, Durango and Dolores Thence it spreads further south and southwestward to Johnson's Basin, Fort Wingate, Magdalena and Silver City, New Mexico, Fort Grant, Fort Whipple and Williams, Arizona, and as far as Zacatecas, Mexico. Its presence in the Great Basin is yet indicated by a single record from the Salt Lake Valley, Utah

In a small area of western Colorado occurs a brachypterous race, *M. occidentalis brevipennis* Bruner

It is interesting to note that, though occurring in the Rocky Mountains in arctic alpine environment, the species is either exceedingly scarce or absent over the northern portions of the Great Plains, but has spread widely over the high semi-arid regions of the southwest

Melanoplus fasciatus (F Walker)

1870 *Caloptenus fasciatus* F Walker, Cat Dermapt Saltat. British Mus, IV, p 680 [♂, ♀, St Martin's Falls, Albany River, Hudson's Bay, [Ontario]]

1897 *Melanoplus alleni* Scudder, Proc U S Nat Mus, XX, p 273, pl XVIII, fig 6 [♂ Crawford County, Iowa, Dakota]

1920 *Melanoplus fasciatus* Morse, Proc Boston Soc Nat Hist, XXXV, p 501

Scudder's synonyms *rectus*, *curtus* and *volaticus* have already been established, as well as McNeill's *baconi* The single type of *alleni*,[illegible] now before us, is clearly a depauperate male of *fasciatus*, the cerci and subgenital plate less heavy than is usual. These latter differences are not very decided and plainly accompany depauperation, having no specific significance whatever We have examined Walker's originally described material in the British Museum, now in bad condition.

Yankton, Springfield, Whitewood, Englewood and Sylvan Lake

These forty adults were secured between June 20 and September 10, the eleven taken in late June all being teneral Those from Yankton and Springfield are depauperate, the others all large and robust

This is a boreal species, its known northern limits being Salmonier and Stephenville, Newfoundland, Nain, Labrador, the Albany River, Ontario, southern Manitoba, Saskatchewan and Alberta, and the Chilcotin District, British Columbia Its southern limits are approximately latitude 40° in the east, but are carried far south by the mountains, the species having been found on Cheah Mountain, Alabama, and War Eagle Ford in Carroll County, Arkansas (recorded as *baconi*) It is apparently absent or exceedingly scarce south of northern North Dakota on the prairies in this latitude, being known in South Dakota only from the extreme southeastern corner, but reappearing abundantly in the Black Hills [illegible] Westward it is also apparently absent over the southern plains, but is again carried southward throughout the Rocky Mountains to the Marshall Pass in Colorado At that longitude its altitudinal distribution in those mountains is known to be from 6900 to 12000 feet West of the Rockies, in the United States, it has been reported only from Loon Lake in the Colville Valley, Washington

The species is sylvan, usually found in an undergrowth of which

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[illegible] Selected in 1912 by Rehn and Hebard, a male from Crawford County, Iowa

[illegible] Previously reported from Custer and Harney's Peak at 7000 to 8000 feet huckleberry bushes are a conspicuous element Though appearing early, the majority of the adults are present in late summer, particularly in the north and at high altitudes

Melanoplus borealis junius (Dodge)

1876 *Pezotettix junius* Dodge Canadian Ent, VIII, p 9 [♂, ♀, Glencoe, Dodge County, Nebraska]
1897 *Melanoplus extremus scandens* Scudder, Proc U S Nat Mus, XX, p 288, pl I, fig f [♂,[70] Mount Washington, New Hampshire]
1920 *Melanoplus borealis* Morse, Proc Boston Soc Nat Hist, XXXV, p 506

The name *scandens*, based solely on the macropterous condition developed in *borealis junius*, is in consequence here assigned to synonymy Provancher's *parvus* is also a synonym of *borealis junius*

We feel that it is advisable to recognize as a geographic race the more southern material of *borealis*, for which the name *junius* is available, as well as *borealis monticola* Scudder of the western mountains The species is, however, subject to great variation and final analysis of the very large series now available may oblige abandonment of any racial recognition whatever We would note that, until recent years, *borealis junius* has been regularly recorded as *M extremus* (Walker), a name now placed as a synonym of the holarctic *M borealis borealis* (Fieber)

Big Stone, Springfield, Deadwood, Whitewood, State Game Lodge and State Game Park

Eighteen adults were secured between June 21 and September 7 The individuals from the Black Hills are unusually large, but otherwise typical of *borealis junius*.

The species prefers bogs and wet meadows in the southern portions of its range

This race, as recognized by us, occurs through northern New England, south in the Appalachian Mountains to Moosick Lake, Pennsylvania,[71] northern Indiana and Illinois, Michigan, Minnesota, North Dakota, Iowa and Nebraska, south to Mountain Grove, Missouri, and in the far northwest at Anahim Lake, British Columbia Its exact limits can not be given until its status has been definitely determined

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[70] We here select the figured male as single type of *scandens*

[71] A pair from this locality in the author's collection were taken August 18, 1924, by Henry Fox

Melanoplus mexicanus atlanis (Riley)

1875 *Caloptenus atlanis* Riley, 7th Ann Rept Nox Benef Ins Missouri, p 169 [♂, ♀, New Hampshire]
1920 *Melanoplus mexicanus atlanis* Morse, Proc Boston Soc Nat Hist, XXXV, p 499

Big Stone, Lake Hendricks, Brookings, Sioux Falls, Canton, Vermilion, Elk Point, Waubay, Volin, Yankton, Springfield, Wessington Springs, Chamberlain, Bijou Hills, Mobridge, Pierre, Capa, Rosebud, Interior, Philip, Martin, Lemmon, Wasta, Scenic, Buffalo, Caputa, Rapid City, Fairburn, Newell, Nisland, Whitewood, Lead, State Game Park, Sylvan Lake and Hot Springs

The four hundred and nine adults were taken between July 12 and October 28 In the more humid sections of the state the great majority have the caudal tibiae pink, very few having these members pale glaucous In the more arid sections, the reverse is true

Two depauperate males from Newell have the tegmina and wings reduced and distorted, as noted for two very similar males of *M femur-rubrum femur-rubrum* (DeGeer) from the same locality.

The species is equally at home in weedy waste land or on the sage-brush plains, its environment having a very decided effect on its general appearance It is generally distributed over all but the tropical lowlands of Mexico, reaching northward over all the United States except peninsular Florida and California west of the Sierra Nevada Mountains, to southern Canada, having also been reported from the Yukon River, Alaska [72] On the Pacific Coast, however, in British Columbia as far north as the Chilcotin District, it is very abundant and widely distributed

Detailed study is needed to determine the number and distribution of the races of *mexicanus* Until then many of the numerous names which have been proposed can not be assigned to synonymy, or given racial status, with any degree of assurance Another difficult problem is that of the migratory grasshopper, known as *M. spretus* (Walsh), which may prove to be only a migratory phase of this same insect Though highly injurious, *mexicanus atlanis*, even in periods of outbreak, at no time has been able to approach the havoc wrought by *spretus* during one of its migratory invasions. None of the material here recorded agrees with material of typical *spretus*

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[72] This latter record, we believe, requires verification

Melanoplus spretus (Walsh)

1866 *Caloptenus spretus* Walsh, Pract Ent, II, p 1 [♂, ♀, Highland, Kansas]

1877 *Caloptenus spretus* Riley, The Locust Plague in the U S, p 17, fig 2 and fig 3 a to e

Thomas' *Acridium spretis*, described in 1864, is not to be confused with *Caloptenus spretus* Walsh, the former has been correctly assigned to synonymy under *M mexicanus atlanis* (Riley) Cockerell's *Caloptenus spretus caeruleipes*[73] has been placed as a synonym of the present insect

The possibility that this insect is a migratory phase of *M. mexicanus atlanis* (Riley) is noted under that species Uvarov has recently shown that *Locusta migratoria* phase *danica* Linnaeus develops a migratory and devastating phase of very different appearance, i e, phase *migratoria*, these phases having long been placed as distinct species belonging to different genera [74] Strong analogy would appear to exist

Though we have no material of *spretus* from South Dakota and it has never been known to appear there except during periods of migration, this state is in direct line with the normal course of its eastward invasions The last year of serious outbreak was 1877, when South Dakota was thinly settled and in consequence less is said of its appearance there than for Kansas, Nebraska, Iowa, Missouri and Minnesota It is probable that South Dakota is more exposed to the ravages of the insect than any of the three latter states, as the source of all migrations appears to have been the Rocky Mountains, particularly in northern Colorado and southern Wyoming

Grasshoppers appearing in myriads in the semi-arid west often represent species other than the present insect, incapable of destruction to any degree comparable The early reports of swarms are therefore unreliable, as the species represented were then not distinguished. It is probable, however, that devastating outbreaks of *spretus* occurred in 1818, 1855, 1866, and 1870 In each case the insects reappeared in myriads during successive years, the 1870 outbreak reaching its peak in 1875 and 1876 During such periods the zone of infestation is annually greatly extended The insect, however, after the first few years, loses its terrific virility and then subsides, disappearing from all the invaded territory

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[73] The Entomologist, XXII, p 127, (1889) Described, by inference, from both sexes, from Glencoe, Nebraska

[74] Bull. Ent Research, XII, pp 135-163, (1921)

Since the subsidence of the last and greatest outbreak in the 70's, *spretus* has become one of the rarest of all forms, even in the regions where it was supposed to have permanent habitat When it will again burst forth to devastate not only counties, but even states, is purely a matter of conjecture

Melanoplus bruneri Scudder

1897 *Melanoplus bruneri* Scudder, Proc U S Nat Mus, XX, p 164, pl XI, fig 7 [♂[76], Fort McLeod, Alberta]

1920 *Melanoplus bruneri* Blatchley, Orth of North-Eastern America, p 413

Though E M Walker placed *M alaskanus* Scudder as a synonym of this species in 1910, we do not believe this action can be taken as justified until examination of the types and study of the group has cleared up a number of difficult problems involved

Englewood, August 30, 1924, 5♂, 5 ♀.

This insect is strictly sylvan in the United States, here living in brushy forest undergrowth In the Chilcotin District of British Columbia, however, we learn that it occurs abundantly on the open range, particularly about clumps of aspen and in grassy depressions

This boreal species will probably not be found in South Dakota except in the Black Hills and their vicinity Its known northern limits are Nipigon and Dwight, Ontario, Kenville and Aweme, Manitoba, localities in southern Saskatchewan and Alberta, north to the Chilcotin District, British Columbia In the United States it has been recorded from Gogebic County, Pequaming and Isle Royale, Michigan, Lake Upsilon in the Turtle Mountains, North Dakota, Gordon, Nebraska, Yellowstone, Fort Ellis, the Madison Valley, Helena and Weeksville, Montana, Old Faithful Geyser, Wyoming, South Park and Florissant, Colorado, Salmon City, Idaho, and Camp Umatilla, Little Spokane, Brown's and Loon Lake, Washington We have also examined material from Norrie and Oregon, Wisconsin

It is a more robust insect than *M. mexicanus atlanis* (Riley), slower in movement but able to leap more powerfully.

The species is much more easily overlooked in this country than forms which prefer an open habitat

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[76] Single type selected by Rehn and Hebard in 1912 Ten other localities originally given

Melanoplus keeleri luridus (Dodge)

1876 *Caloptenus luridus* Dodge, Canadian Ent , VIII, p 11 [♂, ♀, Dodge County, Nebraska]
1920 *Melanoplus keeleri luridus* Blatchley, Orth of North-Eastern America, p 437

The synonymy of *M collinus* Scudder was established by Blatchley in 1903

Sisseton, Big Stone, Lake Hendricks, Lake Albert, Brookings, Sioux Falls, Canton, Vermilion, Waubay, Volin, Yankton, Wessington Springs, Fairfax, Chamberlain, Mobridge, Pierre, Capa, Rosebud, Interior, Bison, Buffalo, Rapid City, Fairburn, Newell, Whitewood, Spearfish, Englewood, State Game Park, Sylvan Lake and Hot Springs.

The two hundred and seventeen adults were secured between August 5 and October 22 All have pink caudal tibiae, usually richly colored, except three males from Hot Springs and Whitewood, which have these members very pale yellowish glaucous This condition has not previously been found in the species and is evidently of extremely rare occurrence

This race is very widely distributed eastward, but is replaced by *M keeleri keeleri* (Thomas) in the southeastern United States The northern limits of *keeleri luridus* are northern New England, Severn River and Hawk Lake, Ontario, Aweme, Manitoba, and the Yellowstone Region of Montana Its western limits of distribution further south are "Wyoming," and Livermore, Denver and Pueblo, Colorado Southward the area of intergradation with typical *keeleri* probably crosses Arkansas and Oklahoma, but has as yet not been critically plotted

We, like Morse, have noted that in the east this race shows a distinct preference for semi-sylvan conditions, especially on rather dry upland soil.

Melanoplus packardi Scudder

1878. *M[elanoplus] packardi* Scudder, Proc Boston Soc Nat Hist, p 288 [♂, ♀ Wallula, Washington, British Columbia, Great Salt Lake, [Utah], South Park and southern Colorado, Nebraska, Texas]
1897 *Melanoplus packardi* Scudder, Proc U S Nat Mus , XX, p 309

Scudder synonymised *M packardi rufipes* Cockerell in 1897. A male of the original series of *M foedus* Scudder, taken at Pueblo, Colorado, August 30 and 31, 1877, by S H Scudder is now before us, through the kind coöperation of the Museum of Comparative

Zoölogy, and is here selected as single type [76] This type fixation substantiates Blatchley's assignment of *foedus* as a synonym of *packardi*, in 1920 [77]

Volin, Hecla, Wessington Springs, Chamberlain, Mobridge, Capa, Martin (in sand hills), Lemmon, Bison, Wasta, Buffalo, Harding County, Rapid City, Newell, Whitewood, Englewood and Hot Springs

The seventy-two adults here recorded were captured from July 8 to September 29 These specimens are all longitudinally trivittate, the degree of intensity varying, as is usual in this plastic species The caudal tibiae are rich glaucous in fifty-nine and rich pink in twelve individuals of the series here recorded

The insect is a prairie and plains dweller, but is very fond of cultivated patches in such regions and undoubtedly is one of the most destructive species annually present, due to its large size and frequent abundance It is very active, jumping powerfully as well as being able to fly well

The northern limits of distribution are[78] Aweme, Manitoba, Regina, Moose Jaw and Radisson, Saskatchewan, Medecine Hat and Calgary, Alberta, and the Chilcotin District of British Columbia. Eastward in the United States it is known to reach Minnesota, Dallas County and Jefferson, Iowa, eastern Kansas, Pine Bluff, Arkansas, Wilburton, Oklahoma, and Dallas and Victoria, Texas. The species has been recorded further west from Santa Fé, New Mexico, south to the Beaver Mountains in Utah (at "8000 to 10000" feet), the Ruby Range, Nevada, and on the Pacific Coast south to Siskiyou County, California In the Colorado Rockies it is found up to 8000 feet on the eastern slopes.

Melanoplus fluviatilis Bruner

1897 *Melanoplus fluviatilis* Bruner, Ann Rept Nebraska Bd. Agr for 1896, p 136, fig 34 [♂, ♀, [Ashland,] Nebraska]

1920 *Melanoplus fluviatilis* Blatchley, Orth of North-Eastern America, p 431

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[76] Another male of the same series, bearing the same data, is in the Hebard Collection This specimen represents instead *M fluviatilis* Bruner, showing that more than one species was included in Scudder's original series of *foedus* In Scudder's revision, material of *fluviatilis* was also recorded as *packardi*, his plate XXI, figure 2, being from another individual of the former species in the author's collection

[77] That author, however, has failed to observe the differences which justly separate the eastern *M stonei* Rehn from the western *packardi* The material recorded that year by Blatchley as *packardi*, from Saginaw Bay, Michigan, actually represents *stonei*, as shown by specimens from that series in the author's collection

[78] Walker's record from Fort William, Ontario, is based on material of *M stonei* Rehn

Blatchley, in 1920, has correctly placed *M macneilli* Hart, as a synonym of this species

Though typically very distinct from *M. packardi* Scudder, sufficient variation occurs in that species to make occasional individuals difficult to separate, the male genitalia being very similar Superficial close similarity to *M angustipennis* (Dodge) is more frequent, but the male genitalia of these species show distinct differences

Elk Point, Yankton, Springfield, Pierre, Capa, Interior, Martin, Wasta, Rapid City, Buffalo, Newell, Whitewood, Spearfish and Hot Springs

The one hundred and thirty-six adults before us were obtained between July 20 and October 22 Eleven of this series have pink caudal tibiae, the others having these members glaucous to varying degrees

The species has been previously reported only from Ashland, Nebraska, Iowa City, Iowa, and near Moline, Illinois A male from Pueblo, Colorado, of this species was originally included by Scudder in the series described as *foedus*, and a female from the same locality was originally described by the same author as his *bowditchi* Another male from West Point, Nebraska, was referred to *packardi* by Scudder in 1897 and figured [79] Additional material, hitherto unreported, is before us from northwest to Columbus, Montana, north to Bismarck, North Dakota, and northeast to St Anthony Park, Minnesota, these records showing that this long unrecognized species enjoys a very much more extensive distribution than has been supposed In the Iowa series secured by Somes the species is represented from thirteen localities.

It is very probable that *fluviatilis* has more than once been reported as *packardi*, or even as *angustipennis*

Melanoplus angustipennis (Dodge)

1877 *Caloptenus angustipennis* Dodge, Canadian Ent, IX, p 111 [♂, ♀, banks of Elkhorn River in Dodge County, Nebraska]

1897 *Melanoplus comptus* Scudder, Proc U S Nat Mus, XX, p 302, pl XX, fig 2 [♂, ♀ northern Minnesota, Sidney, Nebraska [80]]

1920 *Melanoplus angustipennis* Blatchley, Orth of North-Eastern America, p 425

Blatchley placed *M coccineipes* Scudder correctly as a synonym of this species in 1903, as is shown by comparison of the single types Comparison of these with the single type of *M comptus* Scudder, shows that too to be a synonym, based mainly on a feature of individual variation in the male furcula

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[79] Proc. U. S Nat Mus, XX, pl XXI, fig 2

[80] The male from this locality selected as single type, Hebard Collection, Type no 130.

Big Stone, Lake Poinsett, Lake Albert, Sioux Falls, Elk Point, Waubay, Hecla, Pierre, Martin, Lemmon, Bison, Wasta, Scenic, Buffalo, Castle Rock in Harding County, Whitewood and Hot Springs

The one hundred and seventy-six adults were taken between August 20 and September 17 The caudal tibiae in thirty-eight males and twenty-seven females are pink, and in thirty-five males and sixty-seven females are glaucous In one male only the organs of flight fail to reach beyond the base of the supra-anal plate, but this is clearly due to deformity and the subgenital plate is also greatly deformed, being divided into two large irregular lobes

The insect is usually found in poorer grasslands, particularly where the soil is sandy. It is frequently present in great numbers, but we do not believe it to be one of those forms which are liable to attack cultivated areas in dangerous multitudes

The eastern limits of known distribution are Fulton County, Indiana, Douglas Lake, Michigan, and Sudbury, Ontario The northern limits westward are Aweme, Manitoba, and Yellowstone, Montana The insect is limited westward by the Rocky Mountains, but reaches into their eastern foothills up to an elevation of 6000 feet in Colorado Southernmost records are northwestern Indiana, Havana, Illinois, Iowa City and Ames, Iowa, Topeka and Barber and Stephens Counties, Kansas, and Holly to Canyon City, Colorado

Melanoplus flavidus flavidus Scudder

1879 *Melanoplus flavidus* Scudder, Proc Boston Soc Nat Hist, XX, p 74 [♂, ♀, Morrison, Colorado]

1898 *Melanoplus incisus* Scudder, Proc Davenport Acad Nat Sci, VII, p 163 [♂, Fort Collins, Colorado]

1904 [*Melanoplus*] *flavidus* Gillette, Bull 94 (Tech. Ser No 6), Agr Exp Sta Colorado Agr Coll., p 50

Though we have not been able to examine the unique type of Scudder's *incisus*, the description leaves no doubt as to the synonymy In *flavidus* the male subgenital plate shows instability, having its dorsal margin varying from even to slightly produced mesad and occasionally showing a very weak notch On an individual exhibiting the latter condition *incisus* was based.

We here select the described male[81] as single type, loaned for examination through the kindness of the Museum of Comparative Zoölogy. Compared with *M. bowditchi bowditchi* Scudder[82] the present insect differs in being larger and more robust, with proportionately decidedly longer antennae and immaculate tegmina. The browns have an olivaceous tinge and a postocular dark bar is usually absent. In Colorado, as noted by Gillette, these differences enable ready separation, though both species are variable, but in Nebraska and South Dakota assignment of material is decidedly difficult. We would hesitate to separate these as species were it not true that both apparently have southern races, and *bowditchi* an additional northern race, here described. We have reached this conclusion only after detailed study of very large unrecorded series.[83]

Scudder has established the synonymy of *M. cenchri* McNeill.

Waubay, August 21, 1924, 1 ♂. Chamberlain, September 29, 1919, 1 ♂. Martin, September 3, 1923, (in sand hills), 2 ♂, 3 ♀. Buffalo, August 25 and 26, 1924, 2 ♂, 3 ♀.

This handsome insect is extremely variable in size and coloration. It is local in distribution in the eastern portions of its range, being there limited to sand areas. We now have evidence that it intergrades with a southern race, *M. flavidus elongatus* Scudder, in southwestern Kansas, the Pan-Handle of Texas and northeastern New Mexico, and that it does not occur south or southwest of those points.[84] The known northern limits are New Buffalo, Michigan, Lone Rock, Wisconsin (previously unrecorded), Gray Cloud Island, Minnesota, Waubay and Buffalo, South Dakota,[85] and Julesburg and Fort Collins, Colorado. The western limits southward are Golden and Pueblo, Colorado, and a single male is before us from Pleasant Valley, Ouray County,[86] in the southwestern Colorado Rockies Havana, Illinois, is the most southeastern known point

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[81] Figured specimen 1897, Proc. U. S. Nat. Mus., XX, pl. XI, fig. 4.

[82] We here select the described male, taken at Pueblo, Colorado, August 30 to 31, 1877, by S. H. Scudder, as type of *bowditchi bowditchi*. This specimen we have before us, belonging to the Museum of Comparative Zoölogy. It is the individual figured by Scudder in 1897, Proc. U. S. Nat. Mus., XX, pl. XI, fig. 3.

[83] We at present have before us, in addition to the Philadelphia Collections, all of the material previously referred to *flavidus* and *bowditchi* belonging to the Colorado State Agricultural Experiment Station, the United States National Museum, the Museum of Comparative Zoölogy and the University of Kansas.

[84] From examination of the following material, recorded as *flavidus*, we are able to note that Scudder's records from Carrizo Springs, Texas, and Las Cruces, New Mexico, are referable to *flavidus elongatus*, that from Tucson, Arizona, to *M. pictus browni* Caudell. Caudell's from Phoenix, Arizona, and Rehn's from Florence, Carr Canyon and Palmerlee, Arizona, are also referable to *pictus browni*.

[85] We have not been able to verify the record from Aweme, Manitoba, which is very possibly not correct.

In the male genitalia nothing can be found to separate *flavidus* from *bowditchi* or the races of these species Due to this and their variability, they present one of the most difficult problems in the North American Melanopli

Melanoplus bowditchi canus new subspecies

This race agrees closely with typical *bowditchi*[87] in general form and male genitalia, differing only in the average smaller size and gray and streaked coloration It is this latter feature which gives individuals so strong a resemblance to forms of the Cinereus Group, rather than to the other forms of the Flavidus Group

Typically individuals of *M bowditchi bowditchi* Scudder appear very different in the much brighter coloration, with yellows, browns, and almost immaculate gray tegmina Structurally, however, nothing but the average larger size can be found as a difference, and very decided color variation occurs In southeastern Wyoming and southwestern South Dakota, as in the foothills of the Rocky Mountains, various degrees between typical *bowditchi* and *bowditchi canus* are shown, proving that the latter is a more boreal race of the former

Type, ♂, Forsythe, Rosebud County, Montana July 27, 1909 (M Hebard) [Hebard Collection, Type no 1036]

Size small for the Group, form moderately slender[88] Head with sulci and intervening depression on fastigium and frontal costa prominent Pronotum with transverse sulci distinct, mediolongitudinal carina faintly indicated on prozona, prominent on metazona, caudal margin of disk obtuse-angulate produced with apex rounded Prosternal spine elongate conical, rounded apex inclined slightly cephalad Tegmina and wings fully developed, extending well beyond apices of caudal femora Furcula large, represented by fingers, adjacent proximad and over two and one-third times as long as basal width, beyond proximal portion gradually tapering (due to obliquity of the internal margins) to their very slightly thickened, truncate apices Supra-anal plate with a large, low, convex area before apex and beyond furcula, lateral margins convex convergent distad, then briefly straight convergent to the produced apex. Cerci elongate, reaching to near apex of supra-anal plate, narrowing in proximal portion, thence directed dorso-caudad, narrow and of almost subequal width to the rounded apex.[59] Subgenital plate with free margin almost even, showing only slightly greater median convexity. Limbs normal for the genus.

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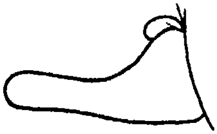
[86] Taken August 19, 1906

[87] Single type selected, page 119, footnote 82 The originally described female, before us, bears the same data, but is referable to *M fluviatilis* Bruner

[88] Material from North Dakota and northeastern Wyoming is distinctly more robust

Allotype ♀, same data as type. [Hebard Collection.]

Agrees closely with type, except as follows. Size larger, form more robust. Vertex and frontal costa broader, with sulcation decidedly weaker. Ovipositor valves short, the dorsal pair very sharply curved distad, apices acute.



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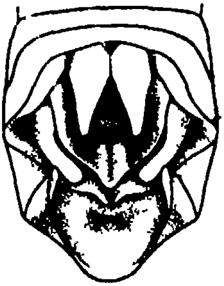

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Melanoplus bowditchi canus new species. Male, *type*. Forsythe, Montana. Fig. 1. Lateral outline of cercus. (Greatly enlarged.) Fig. 2. Dorsal view of apex of abdomen. (Much enlarged.)

MEASUREMENTS (*in millimeters*)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Forsythe, Montana *Type*	20.3	4.8	2.9	16.7	11.3
Forsythe, Montana *Paratypes*	19–23.3	4.8–5.3	3–3.3	16.6–18.8	11.1–12.8
♀					
Forsythe, Montana *Allotype*	24.7	5.8	3.7	21	12.8
Forsythe, Montana *Paratypes*	22.5–25.5	5.1–6.2	3.4–4	17.8–21.1	12.6–14.1

General coloration grayish brown, the tegmina grayer, avellaneous, with moderately numerous, elongate flecks of brown on the veins A postocular dark bar present, broadening on the lateral lobes of the pronotum, but continued only to the principal sulcus, interrupted and invaded by the paler coloration particularly dorsad A few very recessive examples lack all but a trace of this bar, while in a few very intensive individuals it is solid Limbs, abdomen and ventral portions of lateral lobes often cinnamon-buff Caudal femora immaculate, or with faint traces of three transverse bands of brown on the dorsal surface, these dark and conspicuous only in a few very intensive individuals Caudal femora with internal portion of ventral surface and ventral portions of inner surface usually clear antimony yellow, but a richer yellow in some and in the three Colorado specimens rich apricot orange Caudal tibiae pale glaucous blue, in a few very intensive examples (including the three from Colorado) glaucous-blue, spines and spurs black tipped

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[59] Rarely with apex slightly broader and showing a faint external impression of its surface, not to be confused with the distinctly broader cercal apex found in the simplest type developed in the Cinereus Group.

This insect is seen to be primarily a northern Great Plains race, extending in distribution from Medora (and possibly Devil's Lake) North Dakota, and Buffalo, South Dakota, westward to the foothills of the Rocky Mountains from the Marias River, Montana, south probably as far as central Wyoming, and also probably very locally southward along the Rocky Mountains, as is indicated by the material from Austin Bluffs near Colorado Springs, Colorado Material showing a strong tendency toward typical *bowditchi* is from Battle Mountain, South Dakota, and Guernsey, Wyoming

It is of interest to note that *M flavidus flavidus* Scudder also occurs in northwestern South Dakota, reaching that region from the south instead of from the north and west

There is a form of the Cinereus Group which occurs abundantly in the Pacific drainage of the Rocky Mountains in Colorado,[30] thence reaching as far eastward as Rawlins, Wyoming, which very closely resembles the present insect Confusion is almost certain to occur if the distinct distributions of these strongly convergent types of very different phyla is not noted

The race *bowditchi canus* is recognized from a study of very large series of the forms of the Flavidus and Cinereus Groups, and is represented by the following series of sixty-four males and forty-two females

NORTH DAKOTA Medora, July 29 and August 3, 1920, (A. L Olson), 1 ♂, 1 ♀,[31] [Hebard Cln]

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[30] Recorded by Rehn and Hebard in 1906, the males as *M bowditchi* Scudder, the females as *M canonicus* Scudder Gillette refrained from recording the insect, probably due to difficulty in determination, as he had material from four localities.

[31] Recorded by Hubbell as *M flavidus* Scudder, in 1922

South Dakota Buffalo, August 26 and 27, 1924, (H C Severin), 4 ♂, 6 ♀, [Severin and Hebard Clns] Battle Mountain, east of Hot Springs, 3750 to 4400 feet, July 21, 1909, (J A G Rehn), 1 ♂, showing a strong tendency toward *bowditchi bowditchi*, [Hebard Cln]

Montana Glendive, July 26, 1909, (M Hebard, moderately numerous in sage-brush, *Artemisia tridentata* Nuttall), 9 ♂, 7 ♀, [A. N. S P and Hebard Cln], (L Bruner), 3 ♂, 2 ♀, [Hebard Cln] Powderville, July 29, 1904, 1 ♂, 2 ♀, [U S N. M and Hebard Cln] Forsythe, July 27, 1909, (M Hebard, about sage-brush, *Artemisia tridentata* Nuttall), 14 ♂, 9 ♀, *type, allotype, paratypes*, [A N S P and Hebard Cln] Yellowstone Valley, August, 1883, (L Bruner), 6 ♂, 4 ♀, [U S N M and Hebard Cln] Billings, July 20, 1904, 1 ♂, [U S N M], July 28, 1909, (Rehn and Hebard, numerous about sage-brush, *Artemisia tridentata* Nuttall), 19 ♂, 17 ♀, *paratypes*, [A N S P and Hebard Cln]. Marias River, September 5, 1924, (N Criddle,) 1 ♂, [Hebard Cln]

Wyoming Forty miles north of Lusk, July, 1895, 1 ♂, 1 ♀, [A. N S P] Douglas, (L Bruner), 1 ♂, [Hebard Cln] Guernsey, August 13, 1901, (L Bruner), 1 ♂, 1 ♀, showing a very strong tendency toward *bowditchi bowditchi*, [A N S P]

Colorado Austin Bluffs near Colorado Springs, August 9, 1916, (H B Baker, very rare in scrub-oaks), 2 ♂, 1 ♀, [A N S P and Hebard Cln]

As one would expect from its coloration, this insect is normally found in and about sage-brush, *Artemisia tridentata* Nuttall, and is referred to in our notes as the "Sage-brush *Melanoplus*." The Colorado specimens, from Austin Bluffs, were, however, found on scrub-oak

Phoetaliotes nebrascensis (Thomas)

1872. *P[esotettix] nebrascensis* Thomas, Prelim Rept U S Geol Surv Montana and Terr , 5th Rept., p 455 [♀ Nebraska.]

1899 *Melanoplus phoetaliotiformis* Scudder, Proc Davenport Acad. Nat Sci., VII, p 179, pl. VII, fig 9 [♂, ♀ Gazelle, California, Brown's Valley, Minnesota]

1909. *Melanoplus harrisii* Morse, Psyche, XVI, p 12 [♂, Needham, Massachusetts]

1920. *Phoetaliotes nebrascensis* Blatchley, Orth of North-Eastern America, p. 357

For some time we have known, from comparison of very large series that *nebrascensis* enjoyed in the west a much wider distribution than had been supposed Comparison with the single type and paratypes of *M phoetaliotiformis* Scudder showed that no difference exists upon which separation from *nebrascensis* could be based Examination of the type of *M harrisii* Morse further demonstrated that the differences noted for that insect were duplicated in large series in varying combinations and must be ascribed to individual variation As a result, this synonymy was pointed out to Morse in 1920, who published it without discussion, supposing it to have already appeared in print. Other established synonyms are *autumnalis* (Dodge), *sanguineocephalus* (LaMunyon) and *volucris* (Dodge)

Lake Hendricks, Brookings, Canton, Vermilion, Yankton, Springfield, Fairfax, Chamberlain, Bijou Hills, Mobridge, Pierre, Capa, Interior, Martin, Lemmon, Buffalo, Rapid City, Newell, Spearfish, Englewood, State Game Park and Hot Springs

These two hundred and forty-four adults were secured between August 5 and October 26 Forty-five of the present series have fully developed organs of flight, two males have these reduced about one-half, while all the others are brachypterous

This is a grassland species, often appearing abundantly It is found, however, in a variety of situations from marsh to sand areas It is not probable that it ever does much damage to crops

We are convinced that the single New England record is based on an introduced specimen. The known northern limits of the species are Porter County, Indiana, Waukegan, Illinois, Mahtomedi, Wadena and Detroit, Minnesota, Devil's Lake and Amidon, North Dakota, Glendive, Montana, and Walsh, Medecine Hat and Fort MacLeod, Alberta It is apparently barred westward by the Rocky Mountains, but reappears in northern California and at Oliver, British Columbia. Its southeastern limits of distribution are from the easternmost point, Porter County, Indiana, to Colona, Illinois, Fruitland, Iowa; Wilburton and Caddo, Oklahoma, and Dallas, Texas. It sweeps across the plains of northern Texas and New Mexico, appearing in the grasslands of Arizona from San Bernardino Rancho to Tucson and reaching southward over the high plains of Mexico to Cordoba, Vera Cruz, and Tlalpam, in the Distrito Federal

Dactylotum pictum (Thomas)

1870. *P[ezotettix] pictum* Thomas, Proc. Acad. Nat Sci Philadelphia, 1870, p 78. [♂, ♀, eastern Colorado, at base of [Rocky] Mountains]
1908 *Dactylotum pictum* Bruner, Biol Cent.-Amer , Orth., II, p 335.

Mobridge, August 24, 1924, 1 ♀ Walworth County, August 1, 1923, 1 ♀ Capa, August 7 and 30, 1919, 3 ♂, 2 ♀

This, the most striking and brilliantly colored of the Great Plains grasshoppers, reaches its northern limit of distribution along the Missouri River in South Dakota It has been recorded from middle and western Nebraska, Barber County and Great Salt Well in Meade County, Kansas, Mountain Park, Oklahoma, Quanah, Texas, numerous localities in Colorado east of the Rocky Mountains, and the plains of northern New Mexico Previously unrecorded material is also before us from Laramie, Wyoming

The species is local and usually not numerous It is ungainly, sprawling and falling over itself when attempting to escape.

TETTIGONIIDAE

PHANEROPTERINAE

The rare eastern *Phaneroptera septentrionalis* Serville may very possibly occur in extreme eastern South Dakota, as it is known from Minnesota and West Point, Nebraska The species is decidedly the most aboreal of the genus

Phaneroptera pistillata (Brunner)

1878 *Sc[udderia] pistillata* Brunner, Monogr der Phaneropteriden, p 240 [♂, ♀ New York, New Hampshire]
1914 *Scudderia pistillata* Rehn and Hebard, Trans Amer Ent Soc, XL, p 278

Big Stone, Lake Hendricks, White, Brookings, Sioux Falls, Canton, Vermilion, Buffalo, Englewood, Whitewood, Sylvan Lake and State Game Park

These twenty-nine adults were taken from July 7 to October 4 The insect is usually found in bushes, growing in pastures, along fences, or on the edge of forests In South Dakota it occurs only along the eastern border and in the Black Hills Rehn and Hebard previously recorded it from Englewood and Custer in the latter region.

The species is known from Halifax, Nova Scotia and St John, New Brunswick (previously unrecorded) to Chester, New Jersey, on the Atlantic Coast, but has been validly recorded in the Appalachian Mountains from as far south as Bolar, Virginia Its northern limits westward are Isle d'Orleans, Quebec, Algonquin Park and Fort William, Ontario, Winnipeg and Aweme, Manitoba, and Regina, Saskatchewan. Its known southern limits west of the

Appalachians are Steuben, Kosciusco and Fulton Counties, Indiana, southern Illinois, Iowa, and West Point, Nebraska. West of eastern Nebraska and the Dakotas the species is known in the United States only from the Black Hills, Newcastle and Fort Fetterman, Wyoming, and Livingston and Bozeman, Montana In that region its distribution is probably extremely local

Phaneroptera curvicauda curvicauda (DeGeer)

1773 *Locusta curvicauda* DeGeer, Mém l'Hist Nat Ins, III, p 446, pl 38, fig 3 [♀, Pennsylvania]
1914 *Scudderia curvicauda curvicauda* Rehn and Hebard, Trans Amer Ent Soc, XL, p 283

Yankton, August 8, 1924, 1 ♂ Elk Point, September 8, 1924, 1 ♂

To the north this race is narrowly replaced in the Canadian Zone by *P curvicauda borealis* Rehn and Hebard, which occurs from Whitneyville, Maine, to Aweme, Manitoba

South of southern New Jersey, Pennsylvania and Kentucky, it intergrades with and is then supplanted by *P curvicauda laticauda* (Brunner), intermediates occurring over all of Oklahoma and eastern Texas

The present race, between these areas, is known from the Atlantic Coast west to Minnesota, the localities given above and Greene and Dallas County, Iowa [92]

We have usually found this insect in low trees, oaks being preferred It is almost always found in a sylvan or scrub environment [93]

Phaneroptera texensis (Saussure and Pictet)

1897 *Scudderia texensis* Saussure and Pictet, Biol Cent-Amer, Orth, I, p 330, pl XV, figs 18 and 19 [♂, Dallas, Texas.]
1914 *Scudderia texensis* Rehn and Hebard, Trans Amer Ent Soc, XL, p 293

Sioux Falls, Elk Point, Mobridge, Interior, Martin and Buffalo

These thirty-four adults were captured between August 7 and September 15.

This is a common species, preferring a marshy environment It is found over all the eastern United States, as far north as Norway, Maine. Its northern limits westward are Seabrook, New Hampshire, southwestern Ontario, Berrien County, Michigan, Minnesota (by Lugger as *curvicauda*), Mobridge and Buffalo, South Dakota, and Forsyth, Montana Its known western limits south from that point are Casper, Wyoming, Nebraska (by Bruner as *curvicauda*), Morton County, Kansas, and Clarendon and Rosenberg, Texas

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[92] Bruner recorded material of *P texensis* (Saussure and Pictet) as this species from Nebraska, this resulting in Blatchley giving that state as the western limit of distribution for *curvicauda curvicauda* The race will be probably found in extreme eastern Nebraska, but has as yet not been taken there.

[93] This species is certainly not partial to a marshy environment, as is *P. texensis* (Saussure and Pictet) Confusion of these species has more than once occurred

Phaneroptera furcata furcata (Brunner)

1878 *Sc[udderia] furcata* Brunner, Monogr der Phaneropteriden, p 239, fig 72a [♂ Maine, Texas]
1914 *Scudderia furcata furcata* Rehn and Hebard, Trans Amer Ent Soc., XL, p 297

Beutenmuller's *Scudderia fasciata* is an established synonym

Big Stone, Sioux Falls, Canton, Elk Point, Yankton, Springfield, Mobridge, Capa, Interior, Buffalo, Newell, Whitewood, Spearfish and Hot Springs

The thirty-six adults were taken from July 7 to September 15

This is decidedly the most abundant and widely distributed species of the genus It prefers to live in bushes or tall weeds, usually in or on the edge of woodlands It may, however, be found in almost any environment in the regions where it abounds

The species occurs over the greater portion of the United States southward to Guatemala The present race is typical from Brunswick, Maine, to Lakeland, Florida, the southern limits being the Gulf Coast as far as Corpus Christi, Texas Its northern known limits reach from Brunswick, Maine, to Montreal, Quebec, North Bay, Ontario, Sturgeon Bay and Pigeon Falls, Wisconsin, Minnesota, Fargo and the Sheyenne River, North Dakota, and Buffalo, South Dakota Its western limits, continued southward, are Hot Springs, South Dakota, Glen, Nebraska, and Sweetwater and Uvalde, Texas South and west in Texas, New Mexico and Arizona, the Okanagan Valley, British Columbia to Idaho, Washington and as far as south-central California on the Pacific Coast, the species occurs, but not typical of this or the southern race *P furcata furcifera* (Scudder).

Amblycorypha oblongifolia (DeGeer)

1773. *Locusta oblongifolia* DeGeer, Mém l'Hist Nat. Ins, III, p 455, pl 38, fig 2 [♀, Pennsylvania.]
1914 *Amblycorypha oblongifolia oblongifolia* Rehn and Hebard, Trans Amer Ent Soc, XL, p 319

Bruner's *A scudderae* has been correctly placed as a synonym of this species. Without careful examination of the types or large series available of Rehn and Hebard's *A floridana floridana* and

A floridana carinata, Blatchley has, in 1920, placed these as forms or races of *oblongifolia* After exhaustive study these were adequately recognized as geographic races of a species distinct from *oblongifolia* and no subsequent evidence has been produced, nor reason furnished, warranting changing that decision [34]

Canton, Yankton, Springfield, Rosebud and Spearfish

The eleven adults at hand were secured between August 6 and September 5

The genus *Amblycorypha* probably occurs only in the more humid areas of South Dakota The present species is usually found in small colonies, living in vines, bushes or trees

The known northern limits are Seabrook, New Hampshire, Montreal, Quebec, southwestern Ontario, Wayne and Ingham Counties, Michigan, Evanston, Illinois, Wingra Lake near Madison, Wisconsin (previously unpublished), Minnesota, Fargo, North Dakota, and Spearfish, South Dakota Southward its published western limits are Albion, Nebraska, Pueblo, Colorado, South McAlester, Oklahoma, and Dallas and San Antonio, Texas On the Atlantic Coast it has not been found south of Plum Point, Maryland, and Weldon, North Carolina, but probably reaches the Gulf Coast not far westward, as it is known from New Orleans, Louisiana, and Doucette, Texas

Amblycorypha rotundifolia iselyi Caudell

1904 *Amblycorypha iselyi* Caudell, Jour New York Ent Soc, XIII, p 50 [♂, Wichita, Kansas]
1905 *Amblycorypha iselyi* Isely, Trans. Kansas Acad Sci, XIX, p 245
1914 *Amblycorypha rotundifolia iselyi* Rehn and Hebard, Trans Amer Ent Soc, XL, p 340

Lake Hendricks, August 17, 1923, 5 ♂, 5 ♀

This northwestern geographic race of a widely distributed eastern species has been recorded only from Little Rock, Ames and Dallas County, Iowa, Wichita, Kansas, and Iron Mountain, Missouri Southward it is replaced by *A. rotundifolia parvipennis* Stål.

PSEUDOPHYLLINAE

The rare *Pterophylla furcata* (Caudell) is known from the unique type, taken at West Point, Nebraska It is, therefore, very possible that this insect will be found in extreme southeastern South Dakota

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[34] Blatchley's procedure in studying the eastern species of this genus is quite in accord with his hasty and misleading statements concerning several distinctive species of *Melanoplus*

COPIPHORINAE

Neoconocephalus ensiger (Harris)

1841 *Conocephalus ensiger* Harris, Rept. Ins Massachusetts Inj Veget , p 131 [Massachusetts]
1915 *Neoconocephalus ensiger* Rehn and Hebard, Trans Amer Ent Soc , XL, p. 384

Scudder's *attenuatus* is an established synonym of *ensiger*

Big Stone, Webster, Lake Hendricks, Brookings, Canton, Elk Point, Yankton, Springfield, Fairfax, Chamberlain, Mobridge, Capa, Martin, Lemmon and Whitewood

These thirty-four adults were taken between July 30 and September 16 All are green, excepting three males, which are brown

This is locally a common species in grasslands. On the Atlantic Coast it is recorded from Norway, Maine, to Philadelphia, Pennsylvania, but is carried southward in the Appalachian Mountains to North Carolina and Tennessee Its known northern limits are Norway, Maine, Muskoka Lake and the Bruce Peninsula, Ontario, Red River of the North, Minnesota, and Bismarck, North Dakota Southward its western limits are Whitewood, South Dakota, and Julesburg, Colorado Its distribution is carried west of the generally more humid territory largely, if not entirely, by the river valleys Its southern limits west of the Appalachians are so little known that the few records probably give little knowledge of the actual extent The species is, however, abundant in Nebraska and probably does not occur, except at higher elevations, south of Wichita, Kansas.

CONOCEPHALINAE

Orchelimum vulgare Harris

1841 *Orchelimum vulgare* Harris, Rept Ins Massachusetts Inj Veget , p. 130 [Massachusetts]
1915 *Orchelimum vulgare* Rehn and Hebard, Trans Amer Ent Soc , XLI, p 38

Big Stone, Lake Hendricks, Lake Oakwood, Brookings, Sioux Falls, Canton, Vermilion, Elk Point, Yankton, Springfield, Fairfax and Mobridge

The eighty-five adults were taken between July 21 and October 4 One individual only, a male from Springfield, has very elongate tegmina and wings This species is usually found abundant over its wide distribution, preferring an environment of tall weeds and low bushes. It occurs, as a rule, in dry areas, but is sometimes taken in marshes and swamps It has been frequently confused with *O gladiator* Bruner and the southeastern *O glaberrimum* (Burmeister).

The known distribution of the species extends on the Atlantic Coast from Norway, Maine, to Edenton, North Carolina, thence southwest to Raleigh, North Carolina; Macon, Georgia, Tennessee, Fayetteville, Arkansas, and Dallas, Texas Its northern limits are Norway, Maine, Montreal, Quebec, the Muskoka Region, Ontario; north shore of Lake Superior, Minnesota, and Big Stone and Mobridge, South Dakota There it reaches its most northwestern point, other western limital records being eastern Wyoming, and Manitou, Colorado

Orchelimum gladiator Bruner

1891 *Orchelimum gladiator* Bruner, Canadian Ent, XXIII, p 71 [♀, West Point, Nebraska]

1915 *Orchelimum gladiator* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 44

An established synonym of this species is *O manitobense* E M Walker.

Big Stone, Waubay, Lake Hendricks, White, Brookings, Fairfax, Newell, Englewood, State Game Lodge and State Game Park

A grassland inhabitant, this species is probably abundant only in the regions bordering the southern limits of the Canadian Zone It is known on the Atlantic Coast from Norway, Maine, to Winslow Junction, New Jersey. Its northern limits are defined by the former locality, Montreal, Quebec; Berrien County, Michigan, Cranmoor, Wisconsin, Staples, Minnesota, Ashdown and Napinka, Manitoba, and Glendive and Billings, Montana It reappears in the far northwest, having been secured near Ellensburg, Washington, and Sisson, California Past confusion with *O vulgare* Harris is partially responsible for our inability to give less widely separated limital records In North Dakota it is known as far west as Fargo, Devil's Lake and Bottineau

Orchelimum calcaratum Rehn and Hebard

1915 *Orchelimum calcaratum* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 46, figs 1, 22, 43, 44 and 73. [♂, ♀, San Antonio, Texas, and twenty-three other localities.]

1920. *Orchelimum calcaratum* Blatchley, Orth of North-Eastern America, p 550

Capa, August 12 to September 11, 1917 to 1922, 5 ♂, 5 ♀.

This species is usually found among grass and weeds on dry ground

The known limits of its distribution are Capa, South Dakota; Colorado, Wichita Falls, Kerrville and Victoria, east to Doucette, Texas, northeast to Fayetteville and Magazine Mountain, Arkansas, central Missouri, and Oley, Illinois It has also been recently located by Fox at Clarksville, Tennessee, showing that the area which it occupies eastward is still very little known.

Orchelimum nigripes Scudder

1875 *Orchelimum nigripes* Scudder, Proc Boston Soc Nat Hist, XVII, p 459 [♂, ♀, Dallas, Texas]
1915 *Orchelimum nigripes* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 56

Redtenbacher's *O robustum* has been assigned to synonymy under this species

Canton, August 27, 1923, 1 ♀ Vermilion, September 9, 1924, 1 ♂. Yankton, September 27, 1923, 4 ♂ Springfield, September 7, 1924, 4 ♂, 4 ♀.

This insect is known westward to Springfield, South Dakota, the eastern base of the Rocky Mountains in Colorado, and south to Wichita Falls and Victoria, Texas Eastward it is known from New Orleans, Louisiana, Clarksville, Tennessee, Columbus, Ohio, and Point Pelee in southern Ontario Between the two northern localities given other points of distributional limit are Lone Rock, Wisconsin, and along the Mississippi in Minnesota

This beautiful hygrophilous species is confined to borders of lakes, ponds, rivers and streams, where tall vegetation is found growing out of the water

Orchelimum concinnum delicatum Bruner

1891 *Orchelimum gracile* Bruner (not *Orchelimum gracilis* Harris, 1841), Canadian Ent, XXIII, p 70 [♂, ♀, West Point and Lincoln, and Wheeler, Garfield and Holt Counties, Nebraska]
1892 *Orchelimum delicatum* Bruner, Ent News, III, p 265. (New name for *O gracile* Bruner, not of Harris)
1920 *Orchelimum concinnum delicatum* Blatchley, Orth of North-Eastern America, p 556

A synonym of this insect is *O gracilinum*, proposed by Griffini in 1899, who did not know that Bruner had already renamed his *gracile*.

The large series now available for study leads us to believe that the insect must be recognised as a geographic race. It was placed as a synonym of *O. concinnum* Scudder by Rehn and Hebard in 1915, but assigned subspecific rank by Blatchley in 1920.

We reach this conclusion through constant difference shown by the ovipositor over a wide area in the west. This feature alone is admittedly weak and we consider that *concinnum delicatum*, to only a slightly greater degree than *Nemobius fasciatus socius* Scudder, has hardly more than attained sufficient differentiation to warrant racial recognition, in a similarly widespread and plastic species.

Intergradation between *concinnum concinnum* and *concinnum delicatum* has as yet not been found At West Point and Lincoln, Nebraska, and in Indiana, both occur typically. The general agreement, however, is so close that this can hardly be taken as an index of specific rather than racial differentiation and is apparently one of the rare cases where two geographic races of the same species overlap in distribution In this case *concinnum concinnum* has apparently invaded northeastern Nebraska from the south and southeast, *concinnum delicatum* from the north, the presence of the latter in Indiana cannot yet be explained

Additional material only further substantiates the synonymy under *concinnum concinnum* of *longipennis* Scudder, *inerme* Redtenbacher, *indianense* Blatchley and *campestre* Blatchley [11]

Big Stone, Waubay, Hecla, Brookings, Yankton, Elk Point, Springfield, Newell, Nisland, Whitewood, Englewood, State Game Lodge, Sylvan Lake and State Game Park

The series numbers two hundred and thirty-four adults, taken between July 28 and October 4 Considerable size variation is shown, but the largest do not equal the size developed by typical *concinnum* in Texas Frequently, however, a series is, with few exceptions, rather constant in size, thus the Brookings series averages small, while those from Game Park average large, slightly larger than the Springfield series. On the other hand the size variation shows both extremes and intermediates in seven specimens from Whitewood

This is a slender species, the present series of *concinnum delicatum* averaging very slightly more robust than material of *concinnum concinnum* from the Atlantic Coast

The ovipositor shows some slight variation, but is of the longer, more robust and straighter type characteristic of *concinnum delicatum* in all the one hundred and forty-seven females from South Dakota The length of the caudal femur contrasts with that of the ovipositor, in material of *concinnum delicatum* before us, as follows.

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[11] Blatchley resurrects the name *campestre* as a trinomial, stating that it is worthy of a "varietal name" under *concinnum*. We have paratypic material co*fampestre* before us and can find no feature warranting racial recognition

♀	Number of specimens	Length of caudal femur	Length of ovipositor
Starke County, Indiana	(2)	15 8 to 16 3	9 7 to 10 2
Marshall County, Indiana	(1)	16 1	9 8
Big Stone, S D	(1)	15 7	9 7
Waubay, S D	(1)	15 1	10
Hecla, S D	(1)	15	10 1
Brookings, S D	(26)	15 3 to 15 8	10 1 to 10 3
Yankton, S D	(1)	15 9	10 3
Elk Point, S D	(1)	15 8	10 7
Springfield, S D	(40)	15 1 to 18 5	9 9 to 12 1
Newell, S D	(27)	15 5 to 17 2	10 to 10 8
Whitewood, S D	(4)	15 8 to 16 8	9 2 to 12 1
State Game Lodge, S D	(5)	15 1 to 15 2	10 2 to 10 7
State Game Park, S D	(5)	15 to 15 3	10 1 to 10 3
Sylvan Lake, S D	(1)	14 3	9 8
Billings, Montana	(13)	14 7 to 15 4	9 7 to 10 1
West Point, Nebraska	(3)	15 to 14 2	10 3 to 11 2
Cedar Bluffs, Nebraska	(2)	17 to 16 9	11 5 to 12 1
Lincoln, Nebraska	(4)	15 7 to 16 7	11 3 to 13 2
Kearney, Nebraska	(1)	14 8	9 8
North Platte, Nebraska	(8)	14 5 to 15 2	9 2 to 10 4
Julesburg, Colorado	(1)	15 9	10 4
Beulah, New Mexico	(1)	17 2	11 6
Albuquerque, New Mexico	(1)	16 8	10 7

The extremes are seen to be 14 3 to 17 2 for the caudal femora and 9 2 to 13 2 mm for the ovipositor The length of the latter is contained in that of the former 1 3 to 1 55 times, there being much less difference between these proportions than in typical *concinnum*[26]

The distribution of this insect, as known to us, is defined by the records listed above

An effort to find some feature of differences in the male cerci shows that in *concinnum delicatum* these organs average slightly more swollen and blunter distad, the ridge caused by the inner concavity of the surface before the tooth slightly more rounded than in *concinnum concinnum* These features are too weak for safe recognition, particularly as some individual variation occurs. The races of *concinnum* can, therefore, be distinguished only by characters of the female sex

The extremely macropterous condition is occasional in most of the South Dakota series, but far outnumbers the normal, moderately macropterous type in the large series from Game Park.

The face is pale and immaculate in many South Dakota specimens, but in all the larger series some of the individuals show a dark medio-longitudinal vertical suffusion This appears to be augmented by intensification of coloration, some of the Game Park individuals of richest pronotal coloration having it very broad and dark and the genae entirely suffused with the same color

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[26] The ovipositor in that race varies from slightly less to slightly more than half the length of the caudal femur.

Conocephalus fasciatus fasciatus (DeGeer)

1773 *Locusta fasciata* DeGeer, Mém l'Hist Nat Ins, III, p 458, pl 40, fig 4 [♀, Pennsylvania]
1915 *Conocephalus fasciatus fasciatus* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 170

Harris' *Orchelimum gracilis* has been placed as a synonym of this insect

Hecla, Waubay, Big Stone, Lake Hendricks, Lake Oakwood, Brookings, Canton, Yankton, Springfield, Fairfax, Interior, Lemmon, Buffalo, Newell, Englewood, State Game Lodge and State Game Park

These one hundred and twenty-six specimens were taken from July 12 to October 4 The insect occurs only in green grasses and is partial to cultivated areas It is usually moderately abundant wherever found over its very extensive area of distribution The present race is supplanted in the region of Pacific drainage by *C. fasciatus vicinus* (Morse).

Its known northern limits of distribution are Prince Edward Island, North Bay and Whitemouth, Ontario, and Aweme, Manitoba. Southward it occurs over all the United States to the Mexican boundary, its western published limits being Del Rio, Texas, Springer and Rociada, New Mexico, the eastern foothills of the Rocky Mountains in Colorado, Wyoming and Montana, as far as Billings in the latter state The British Columbian records are probably all referable to *fasciatus vicinus*, material before us from Fairview, Vernon and Salmon Arm representing that race. Outside the United States and Canada we have material from Bermuda, but *fasciatus fasciatus* undoubtedly also occurs in northeastern Mexico.

Conocephalus brevipennis (Scudder)

1862 *Xiphidium brevipennis* Scudder, Canadian Nat and Geol, VII, p 285 [♀, New England]
1920 *Conocephalus brevipennis* Blatchley, Orth of North-Eastern America, p 570

Established synonyms of this species are Scudder's *ensiferum* and *gossypii*.

Big Stone, Brookings, Canton, Yankton and Springfield

These eighty-four adults were taken between August 1 and October 4 Two females of this series have caudate organs of flight

The species frequents grassy spots like *C fasciatus* (DeGeer), but often occurs in more weedy waste areas than that species It is also more local, though, when found, usually abundant

Its known distribution extends from Eastport, Maine, Montreal, Quebec, and Algonquin Park, Ontario, south to Atlantic Beach, Florida, and the Gulf Coast as far as Beaumont, Texas The western limits between are Big Stone, Brookings and Springfield, South Dakota, North Platte, Nebraska, and (probably) Dallas, Texas.

Conocephalus nemoralis (Scudder)

1875 *Xiphidium nemorale* Scudder, Proc Boston, Soc Nat Hist, XVII, p 462 [♂, ♀, Dallas County, Iowa]

1915 *Conocephalus nemoralis* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 189

Redtenbacher's *curtipenne* has been placed as a synonym of this handsome species

Elk Point, Vermilion, Yankton, Springfield

The forty-five adults were captured between September 7 and 27 All are brachypterous. The insect prefers a dry upland environment, where, in low shrubs, vines and weeds on the borders of woods and along roads, it is often present in moderate numbers

Widely distributed over the upper Mississippi region, it is known north to West Spring Green, Wisconsin Its limits of distribution can not yet be given in accurate detail, but it has been taken east to the Hudson Palisades, New Jersey, Harrisburg, Pennsylvania, Washington, District of Columbia, and Asheville, North Carolina, westward as far as Springfield, South Dakota, Lincoln, Nebraska, Wichita, Kansas, and Dardanelle, Arkansas, north to New Buffalo, Michigan

Conocephalus strictus (Scudder)

1875. *Xiphidium strictum* Scudder, Proc Boston Soc Nat Hist, XVII, p 460 [♀, Dallas, Texas]

1915 *Conocephalus strictus* Rehn and Hebard, Trans Amer. Ent Soc, XLI, p 193

Big Stone, Yankton, Springfield, Chamberlain, Mobridge, Capa, Newell, Whitewood, State Game Lodge, State Game Park and Hot Springs

These one hundred and twenty-three adults were taken from August 6 to September 27, three females from Springfield alone having fully developed organs of flight

The insect is usually local in distribution, preferring areas of poor soil overgrown with dry grass, where it is often found in large numbers It occurs, however, also in open grassy woodlands and on the borders of coastal salt marshes

On the Atlantic Coast it is known from Staten Island, New York, to Newbern, North Carolina, being absent from the south-eastern United States, but west of the Appalachian Mountains probably reaching to or near the Gulf Coast. Westward it is known as far north as northern Ohio and Indiana, Washtenaw County, Michigan, Madison, Wisconsin (previously unpublished), and Big Stone and Newell, South Dakota Its western limits thence are Whitewood and Hot Springs, South Dakota, Kearney, Nebraska, Syracuse, Kansas, and Cisco, Del Rio and Brownsville, Texas In the mountain regions of the arid southwest it reappears in New Mexico and Arizona.

Conocephalus nigropleurum (Bruner)

1891 *Xiphidium nigropleurum* Bruner, Canadian Ent, XXIII, p 58 [♂, ♀, eastern Nebraska to Antelope County]
1915 *Conocephalus nigropleurum* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 205

Big Stone, White, Brookings, Canton, Springfield and Fairfax.

The thirty-nine adults were secured between August 6 and October 3 All are brachypterous This is a hygrophilous species and one of the handsomest of the genus

It is known north to Ithaca, New York, extreme southwestern Ontario, Milford and Gull Lake, Michigan, Lone Rock, Wisconsin, and Big Stone, South Dakota. The western limits southward are Fairfax, South Dakota, and Halsey, Nebraska The southernmost records are the Ohio River in Indiana, Watertown, Illinois, Denison, Iowa, and Lincoln, Nebraska

Conocephalus saltans (Scudder)

1872 *Xiphidium saltans* Scudder, Final Rept U S Geol Surv Nebraska, p 249 [♂, ♀, banks of Platte River, Nebraska]
1915 *Conocephalus saltans* Rehn and Hebard, Trans Amer Ent Soc, XLI, p 216.
1920 *Conocephalus viridifrons* Blatchley, Orth of North-Eastern America, p 583 [♂, ♀ Toronto, Ontario, Central Park, Long Island, New York.]

Previously established synonyms are Bruner's *modestum* and Redtenbacher's *taeniatum*. We here add the recently described *viridifrons* This action is unavoidable as, after detailed study of several hundred specimens, we are convinced that topotypes before us of both *saltans* and *viridifrons*[97] are wholly inseparable Blatchley used, to separate the latter a color feature which is plainly of no diagnostic value[98], individual variability in tegmina and ovipositor covers the differences noted for these appendages[99], the shorter and more compact form and shorter and more simple male cerci alone remain as possible characters to be considered.

The differences, as given for *saltans* by Blatchley, we find in examining a large series yet unreported, hold true for material from the southeastern United States, and only occasional individuals from Pennsylvania show divergence toward the condition described as *viridifrons* Variability in the cercal length of western and northern individuals occurs, but never are these appendages as elongate with apices as modified as described and figured by Blatchley [100] It is therefore evident that Blatchley's *saltans* is the southeastern development of the species, which we discussed in 1915 as showing incipient racial differentiation, but which we did not consider sufficiently marked or constant to warrant nominal recognition, while his *viridifrons* is typical *saltans* [101]

Hecla, Waubay, Big Stone, Lake Hendricks, Brookings, Yankton, Springfield, Chamberlain, Mobridge, Pierre, Capa, Interior, Martin (in sand hills), Lemmon, Buffalo Newell, Whitewood, Englewood, Hermosa, State Game Lodge, Sylvan Lake, State Game Park and Hot Springs

The ninety-nine adults were taken between August 5 and October 3, seventeen of which are macropterous The majority have face, genae, lateral lobes of pronotum and lateral portions of thorax and abdomen light but rich green, in some these areas are paler and greenish white or greenish yellow-brown, while in a very few all trace of green is absent The face is normally immaculate, but in a few specimens it has a broad vertical suffusion of brown and the genae are also suffused with that color, also in a few paler individuals such suffusions are weakly indicated. In eastern and southern material rare individuals of dark coloration are similarly marked, the suffusions covering all of the face and genae in some of these

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[97] As Blatchley failed to designate or figure a type for *viridifrons* and gave several localities for it, we here select as type locality Toronto, Ontario

[98] Presence of a vertical facial suffusion has no specific or racial significance in this species

[99] The tegmina become more truncate with increasing reduction and show a somewhat variable degree of reduction in all large series

[100] His figure of *saltans* is from a male before us from Wilmington, North Carolina

[101] Hurried examination of both the types of *modestum* and *saltans* and the large series available was probably the reason for this error

The distribution of this species, though highly discontinuous in the east, is known to reach from Nantucket Island, Massachusetts, to Yemassee, South Carolina and Thomasville, Georgia, southwestward reaching the Gulf Coast Its northern recorded limits westward are Toronto, Ontario, the Red River, Aweme and the Souris River, Manitoba, and Moose Jaw, Saskatchewan Other western limital records are Livingston, Montana, Fort Collins and Manitou, Colorado, Springer, New Mexico, and Amarillo and Dallas, Texas

The insect, like *C strictus* (Scudder), prefers dry open[102] sandy areas of short dry grass and is, as a rule, likewise locally quite numerous

DECTICINAE

Pediodectes haldemanii (Girard)

1853 *Anabrus haldemanii* Girard, Marcy's Expl Red River, p 230, pl XV, figs 5 to 8 [♀, Red River [in Panhandle of Texas or southwestern Oklahoma]]

1907. *Stipator americanus* Caudell, (not *Orchesticus americanus* Saussure, 1859, except reference), Proc U S Nat Mus, XXXII, p 341

This species was for some time recognised incorrectly as Saussure's *Orchesticus americanus*, a name now referred to a valid species of the genus *Atlanticus* An established synonym of *haldemanii* is *Thyreonotus cragini* Bruner

Capa, August 7 to 26, 1919, 6 ♂, 1 ♀

This is one of the largest as well as one of the handsomest species of the North American Decticinae. It is moderately abundant in certain portions of the Great Plains and is usually found during the day time in small bushy plants.

It has been recorded from eastern Wyoming, Colorado, Arkansas[103] and Texas[104] and as *cragini* from southwestern Nebraska, and Barber and Wallace Counties, Kansas [105]

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[102] The southeastern material we have discussed above occurs in the wire-grass of the sandy pine woods, there usually in or about oak shoots

[103] This record of Scudder's requires verification

[104] The species does not occur in the more humid eastern portion of Texas

[105] The Tennessee record given by Caudell was based on the type of *Atlanticus americanus* (Saussure) and not on material of the present species.

Pediodectes stevensonii (Thomas)

1870 *Anabrus stevensonii* Thomas, Proc Acad Nat Sci. Phila, 1870, p 75 [♀, southern Colorado, near mountains]
1907 *Stipator stevensonii* Caudell, Proc U S Nat Mus, XXXII, p 344

Established synonyms are *Anabrus minutus* Thomas and *Thyreonotus scudderi* Bruner

Capa, August 7 to September 26, 1919, 6 ♂, 9 ♀ Martin, September 3, 1924, 1 ♂, 2 ♀, 1 large juv ♂ Hot Springs, August 7, 1922, 1 ♂, 1 ♀, August, 1882, (L Bruner), 2 ♂, 1 ♀

The distribution of this species covers the Great Plains. The above records define the northeastern limits, other easternmost records being western Nebraska, Great Salt Well in Ford County and Barber County, Kansas (as *scudderi*) Westward it is known from southern Colorado, and La Trementina in northeastern New Mexico [104] The insect occurs far northward in the western portion of its distribution as is shown by previously unreported material before us from Huntley and Park City, Montana

In Texas a much more richly colored insect occurs, which has been described as *P bruneri* by Caudell It is extremely close to *stevensonii*, but whether species, race or synonym can only be determined by revisionary study of large series

This insect is often found in small bushy plants on the plains, but usually is present in small numbers

Pediodectes nigromarginata (Caudell)

1907 *Stipator nigromarginata* Caudell, Proc U S Nat Mus, XXXII, p 346, fig 44 [♀, Texas (Type) ♂, ♀, Perkins, Oklahoma, Clearwater and Lakin, Kansas, Brownsville, Texas]
1907 *Stipator nigromarginatus* var *griseus* Caudell, Proc U S Nat Mus, XXXII, p 347 [♂, ♀, Haigler, Nebraska]

Caudell's variety *griseus* is merely a color phase, which should not be given nominal recognition This insect is extremely close to *P grandis* (Rehn), appearing to it much the same as *P stevensonii* (Thomas) does to *P. bruneri* (Caudell) Detailed study of large series will likewise be necessary to place it as a distinct species, race or synonym

Springfield, September 7, 1924, 1 ♀ Bijou Hills, August 31, 1923, 1 ♀. Chamberlain, August 31 and September 1, 1923, 2 ♂, 1 ♀ Capa, August 13 to September 26, 1919 and 1922, 8 ♂, 8 ♀

This insect is known only from the localities given here for South

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[104] There is no doubt that the species does not occur in Florida, as Caudell suggested, when reporting a specimen so labelled in the National Museum

Dakota and those of the above references Its habits and favorite habitat are probably very similar to those of *P stevensonii* (Thomas).

One of the most striking species of the Great Plains is the large and heavy, but often surprisingly active, *Anabrus simplex* Haldeman As it is known from middle and western Nebraska, as far southeast in North Dakota as Bismarck, and also from Donaldson and Argyle in extreme northwestern Minnesota, there is little doubt that it will be found in western South Dakota, though as yet unknown from this state

Caudell's variety *nigra* and variety *maculatus* are color phases unworthy of nominal recognition, while *purpurascens* Uhler and *similis* Scudder are established synonyms

STENOPELMATINAE

The extraordinary *Stenopelmatus fuscus* Haldeman is now known as far eastward as Marmarth, North Dakota, and Boxbutte County, Nebraska, as well as from near the South Dakota line on Hat Creek, Sioux County, in the latter state It is, therefore, almost certain to be found in western South Dakota

The species enjoys a very wide range over all of the western United States as far north as Jordan, Montana, and Yakima, Washington Living in the ground and rarely emerging other than at night unless drowned out, the insect is seldom encountered

RHAPHIDOPHORINAE

Ceuthophilus maculatus (Harris)

1841 *Rhaphidophora maculata* Harris, Rept Ins Massachusetts Inj Veget, p 126 [Massachuestts]

1894 *Ceuthophilus seclusus* Scudder, Proc Amer Acad Arts and Sci, XXX, p 45 [♂, ♀ Dallas and Crawford County, Iowa, West Point, Nebraska]

1920 *Ceuthophilus maculatus* Blatchley, Orth of North-Eastern America, p 622

After study of material from both eastern and western localities, including a paratypic female of *seclusus* from West Point, Nebraska, we are convinced of the synonymy indicated above Scudder's work on the Ceuthophili uses so many valueless characters and is so full of errors, that little can be ascertained from it without actual examination of the material treated Scudder's *latebricola* and *bicolor* have been previously assigned to the present synonymy.

Springfield, August 6 to 26, 1923, and 1924, 2 ♂, 4 ♀.

This is a common species, found from Nova Scotia and New England west to Manitoba and south to Kentucky, Missouri and Kansas. Records must be verified before a more detailed distribution can be given with safety. We do not believe that the species occurs in Colorado. Western material is before us from Wisconsin, Minnesota, Iowa City, Iowa, and Winnipeg and Douglas, Manitoba, while there is no reason to question Hubbell's records from Devil's Lake, Pembina and Grand Forks, North Dakota

Ceuthophilus caecus Scudder

1894 *Ceuthophilus caecus* Scudder, Proc Amer Acad Arts and Sci, XXX, p 60 [♂, ♀, Lexington, Kentucky]

1920 *Ceuthophilus caecus* Blatchley, Orth of North-Eastern America, p 637

Blatchley has placed Scudder's *sallei* and *occultus* as synonyms of this species[107]

Canton, June 16, 1924, 1 ♂, 1 ♀, 1 juv ♂, 1 juv ♀ Elk Point, June 19, 1924, 3 ♀ Springfield, August 6, 1924, 1 ♀

This species has been recorded only from Lexington and Hickman, Kentucky, *sallei* from New Orleans and DeFuniak Springs, Florida, and *occultus* from Georgia Fourteen individuals, however, are before us, taken at various localities within the city limits of Philadelphia, Pennsylvania, which agree closely with the South Dakota series It is evident that it is a very widely distributed species and that its range can not at present be defined with accuracy

Ceuthophilus fusiformis Scudder

1894 *Ceuthophilus fusiformis* Scudder, Proc Amer Acad Arts and Sci, XXX, p 62 [♂, Lincoln, Nebraska]

1894. *Ceuthophilus testaceus* Scudder, Proc Amer Acad Arts and Sci, XXX, p 92 [♂ type, West Point, Nebraska ♂, ♀, Sheridan, Wyoming[108]]

The male type of *testaceus* is an immature example of pallid and almost uniform color It differs in no way except the recessive coloration from material in the same instar and from the same locality of undoubted *fusiformis*. There is also another similar male from West Point, and three small and pallid adult females from West Point and Sheridan, Wyoming As a result we have no hesitation in placing *testaceus* in the present synonymy. The male from Pine Ridge, Nebraska, recorded by Scudder as *pallescens*, is also a pallid immature individual of *fusiformis*, though the selected female type of Bruner's *pallescens* shows that name to be a synonym of *C uniformis* Scudder The series recorded as *C vinculatus* by Scudder from Lincoln, West Point and Holt County, Nebraska, is referable in all cases to *fusiformis*

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[107] Additional material, we believe, is needed of the larger and paler southern insect to prove that it is not worthy of racial or possibly even specific recognition

[108] The St. Louis, Missouri, specimen must be examined It almost certainly represents a different species

Capa, May 9 and 10, 1919 and 1922, 1 ♂, 1 ♀, 1 large juv ♀ Whitewood, June 26, 1923, 2♂; August 29, 1924, 2♀. Fairburn, September 8, 1923, 1 ♂. Hot Springs, September 8, 1923, 1 ♀

The type of this species is rather large and very intensive in coloration, with dorsal surface of abdomen almost solidly brown. The majority of the thirty-nine individuals now before us have each abdominal tergite yellow brown proximad and dark brown distad, giving a strongly banded appearance. In some the dark markings are weak and in others almost obsolete Very decided size variation occurs

The males from Capa and Whitewood have the transverse truncation of the ultimate tergite wider than in those from Nebraska or the Fairburn male, while the Capa male has the two rounded triangular portions of the subgenital plate much more elongate than it is in the others So closely do these individuals agree in all other diagnostic features that we do not believe these differences signify more than individual variation, though such is rarely found in the genitalia.

In this species the male cerci are decidedly but evenly thickened, with joints fused in the proximal three-fifths, the dried material all having the ventral surface of this area concave. The ultimate tergite is produced and very broadly convex truncate, this area with a narrow subchitinous production of apparently the ventral surface of the tergite whose caudal margin is transverse, thus filling the feeble concavity at its juncture with the chitinous portion of the tergite

In addition to the material discussed above we have before us a dark male from Barber County, Kansas, and a small pallid female from Orion, Alberta.[189]

The known distribution of this species is thus seen to extend north from Regina, Saskatchewan, to Orion, Alberta, and west to Sheridan, Wyoming, Hot Springs, South Dakota; Pine Ridge, Nebraska, and Barber County, Kansas It is known eastward to the south as far as Capa, South Dakota, and West Point and Lincoln, Nebraska

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[189] Belonging to the Canadian National Collection and taken September 9, 1924, by N Criddle

Material of *C uniformis* Scudder is in the author's collection from Hat Creek[110] and Glen, Nebraska, and the species will almost certainly be found in extreme southwestern South Dakota We have full evidence to support placing *C valgus* Scudder and *C pallescens* Bruner as synonyms of this species Hubbell recorded it as *Ceuthophilus* sp from Bottineau, North Dakota, in 1922 We have material before us from as far north as Gledden, Saskatchewan,[111] and from the series it is seen to be the dominant and most generally distributed species in the Rocky Mountains, reaching as far south as the Davis Mountains, Texas, and the Sacramento Mountains (at Cloudcroft), New Mexico.

Ceuthophilus divergens Scudder

1862 *C[euthophilus] divergens* Scudder, Boston Jour Nat Hist, VII, p 436 [♂, ♀, Nebraska]
1872 *Ceuthophilus pallidus* Thomas, Prelim Rept U S Geol Surv Montana and Terr, 5th Rept, p 434 [♂, ♀ southeast Colorado, near Red Buttes, Wyoming]
1894 *Ceuthophilus bruneri* Scudder, Proc Amer Acad Arts and Sci, XXX, p 79 [Selected type ♀, Lincoln, Nebraska]
1894 *Ceuthophilus inquinatus* Scudder, Proc Amer Acad Arts and Sci, XXX, p. 87 [♂, ♀, Fairbury and Lincoln, Nebraska]
1894 *Ceuthophilus discolor* Scudder, Proc Amer Acad Arts and Sci, XXX, p 88 [Selected type ♂, West Point, Nebraska]
1907 *Ceuthophilus tuckeri* Rehn, Ent News, XVIII, p 445, text fig [♂, Lawrence, Kansas]

Study of the literature, a considerable series before us, the original descriptions of *divergens*, *pallidus* and *tuckeri*, and the types in the author's collection of *bruneri*, *inquinatus* and *discolor*, offers convincing proof of the synonymy indicated above Thomas was in doubt as to the validity of his *pallidus*, but features, now known to be of no value, led him to describe it as distinct from *divergens* It is difficult to realize how Scudder, in a generic revision, could have placed material of one species under five different specific names This he did, as material before us, from Hot Springs, South Dakota, and Denver, Colorado, which he recorded as *pallidus*, also represents *divergens*. The material upon which *bruneri* was based had previously been determined by Osborn and Bruner as *divergens*, while that described as *inquinatus* had been determined by Bruner as *divergens* Scudder's confusion apparently arose largely through use of indefinite or worthless characters in his unworkable key Rehn's description of *tuckeri* leaves no doubt as to its synonymy

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[110] The female type of *C pallescens* Bruner

[111] A female taken August 15, 1922, by K M King, property of the Canadian National Collection

The nearest relative of this insect is clearly *C variegatus* Scudder

Canton, Yankton, Capa, Newell, Spearfish and Hot Springs

These twenty individuals were secured between July 16 and August 28 Four are immature, taken June 19, July 28 and August 28 The Yankton and Canton individuals are somewhat darker in coloration than the others Those from Capa and Spearfish and a male from Newell are large, the others considerably smaller, this being particularly true of two apparently adult males from Newell

A male and three females from Aweme, Manitoba,[112] appear referable to this species, though very small, considerably darker and with male caudal femora decidedly less strongly armed than is usual This record indicates the known northern limit, other more typical material being before us from West Point, Lincoln, Fairbury, Glen and Sidney, Nebraska, Sedgwick[113] and Barber County, Kansas, Worland, Wyoming, Boulder and Denver Colorado, and Jemez Hot Springs, Albuquerque and Fort Wingate, New Mexico

With the confusion that has existed all records should be verified, but we believe that the following properly apply to the present species Plains of northern New Mexico and Las Cruces, Mesilla and Silver City, in that state, by Scudder and Cockerell as *pallidus* Laramie, Wyoming, and Custer, Colorado, by Scudder as *pallidus* Montana by Thomas as *divergens* Ellis, Kansas, by Scudder as *discolor*, and Topeka, Kansas, by Bruner as *pallidus*

We believe that the Gulf Coast of Texas record originally given for *bruneri* by Scudder, however, does not apply to the present insect The Carrizo Springs, Texas, males there discussed by Scudder are before us and represent immature examples of *C variegatus* Scudder.

A distributional summary shows that *divergens* reaches north to Aweme, Manitoba, and west to Montana, the Rocky Mountains acting as a barrier until New Mexico is reached, where the insect extends west as far as Fort Wingate and Silver City Its known eastern limits are Canton, South Dakota, West Point and Lincoln, Nebraska, and Lawrence and Sedgwick County, Kansas We do not believe that its distribution is carried far southward of Kansas

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[112] Taken September 2, 1912, by N Criddle.

[113] Paratype of *bruneri*

Daihinia brevipes Haldeman

1850 *Ph[alangopsis]* (*D[aihinia]*) *brevipes* Haldeman, Proc Amer Assn Adv Sci 2d Meeting, p 346 [♂, ♀, vicinity of Platte River]
1916 *Daihinia brevipes* Caudell, Proc U S Nat Mus, XLIX, p 685

Martin June 24, 1924, 1 juv ♀ Ardmore, July 18, 1915, (E G Holt), 1 ♂

This species, which superficially somewhat resembles *Udeopsylla robusta* Haldeman, is decidedly scarcer and has a much less extensive distribution It has been previously recorded from the Black Hills, South Dakota

It is known to extend from the "upper waters of the Red River of Arkansas" to Fort Laramie, Wyoming, south to Clark County, Kansas, and southern Colorado (east of the Rocky Mountains) It apparently is more abundant in the sand hills of northwestern Nebraska than elsewhere

Udeopsylla robusta Haldeman

1850 *Ph[alangopsis]* (*D[aihinia]*) *robusta* Haldeman, Proc Amer Assn Adv Sci, 2d Meeting, p 346 [♀, North America]
1916 *Udeopsylla robusta* Caudell, Proc U S Nat Mus, XLIX, p 687

Caudell has placed as synonyms *Marsa arcuata* Walker, *Udeopsylla compacta* Bruner and *Ceuthophilus politus* Scudder He has retained as color varieties *Udeopsylla nigra* Scudder and *Ceuthophilus devius* Scudder As we can not sanction nominal recognition of such, we place them also in the present synonymy, as well as the synonyms established by Caudell for *nigra, Ceuthophilus niger* Scudder, *Daihinia gigantea* Bruner and *Ceuthophilus ater* Scudder

White, Brookings, Yankton, Pierre, Capa, Newell, Whitewood, Spearfish, Rapid City and Hot Springs

Thirty-three specimens are before us, the adults taken between June 17 and October 26 Small immature individuals were secured May 31 and November 9 From the series it appears that the majority reach maturity in South Dakota early in July

This large, robust, flightless katydid is nocturnal, like the species of *Ceuthophilus* rarely venturing abroad in the day time It is a terrestrial insect and unless its hiding places are located is rarely secured, though probably often present in moderate numbers

The species is known in Manitoba from the Red River to Carbery, Elgin and Deloraine Southeastward it has been recorded from the Red River Valley and Hamline, Minnesota, eastern Illinois, and thence southwestward from Sedalia, Missouri, Austin, Texas, to Albuquerque and Las Vegas, New Mexico. Northwestward it occurs as far as the Rocky Mountains in Colorado, Wyoming and Montana, and has been reported from southern Idaho and Utah

We have not been able to verify Scudder's records from Arizona and El Dorado County, California These are decidedly questionable, as the specimen recorded by that author from Pasadena, California, is before us and represents a distinct species

Tachycines asynamorus Adelung

1902 *Tachycines asynamorus* Adelung, Ann Mus Zool Pétersbourg, VII, p 59, text-figs a, b, c [♂, ♀, St Petersburg Russia, introduced on plants]
1916 *Diestrammena marmorata* Caudell, (not *Locusta* (*Rhaphidophorus*) *marmorata* Haan, 1842) Proc U S Nat Mus, XLIX, p 659
1920 *Diestrammena japanica* Blatchley, Orth of North-Eastern America, p 611, fig 205
1920 *Tachycines asynamorus* Karny, Zool Mededeel, V, p 143
1921 *Tachycines asynamorus* Chopard, Bull Soc Ent France, 1921, p 209

Much confusion resulted in the incorrect, but for some time generally accepted, determination of this insect as *Diestrammena marmorata* (Haan) Unfortunately, the year this was definitely corrected by Karny, Blatchley (before Karny's paper was received) redescribed this species under the name *japanica*, that name therefore falling in the present synonymy. His action was due to the fact that he found *Locusta marmorata* Haan to be a primary homonym requiring a new name That species, as we now know from Karny's description of Haan's type, is not even congeneric with *asynamorus*

Brookings, March 13 to December 14, 1917 and 1919, 4 ♂, 10 ♀. May 26, 1919, 3 juv. ♂

These individuals were taken in a greenhouse and cellar The species, introduced from Japan, has a wide distribution in such places both in America and Europe It is known from Ontario, Massachusetts, Rhode Island, New York,[114] Ohio, Tennessee, Michigan, Illinois,[115] Wisconsin, Minnesota, Kansas and Colorado.

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[114] Material is in the author's collection from Elmhurst, Long Island
[115] First recorded as *Diestrammena unicolor* by Morse

GRYLLIDAE

GRYLLINAE

Gryllus assimilis (Fabricius)

1775 [*Acheta*] *assimilis* Fabricius, Syst. Ent., p. 280. [Jamaica.]
1915 *Gryllus assimilis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1915, p. 295.

Forty-five synonyms of this species are known. As Blatchley uses variety or race interchangeably, and does not recognize the significance of the latter as used in modern biology, he in 1920, places six[116] of these as trinomials (an index of racial status) though referring to them as forms. We believe that the word "variant," used by Rehn and Hebard, was well chosen, as no geographic races of this species appear to exist and "form" has been used in so many ways that it has virtually lost any real significance.

Brookings, Pierre, Capa and Scenic.

A series of adults was secured between May 12 and October 5.

This insect occurs from southern Canada to Patagonia, and is easily the most variable of the species of American Orthoptera. In the 1915 study by Rehn and Hebard its major "variants" are discussed in detail.

The variable *Miogryllus verticalis* (Serville) is known from Staten Island, New York, and South Bend, Nebraska, to the Argentine Republic. It may, therefore, very possibly occur in southern South Dakota, though not yet known from the state. Its habits probably much resemble those of *Gryllus assimilis* (Fabricius), but it is a far less abundant insect. Established synonyms are Saussure's *laplatae* and *guyennensis*, Scudder's *saussurei* and Caudell's *oklahomae*.

NEMOBIINAE

Nemobius fasciatus fasciatus (DeGeer)

1773 *Gryllus fasciatus* DeGeer, Mém. l'Hist. Nat. Ins., III, p. 522, pl. 43, fig. 5. [♀, Pennsylvania.]
1913 *Nemobius fasciatus* Hebard, Proc. Acad. Nat. Sci. Phila., 1913, p. 405.

The established synonyms of this race are Fabricius' *hospes*, Harris' *vittata* and Scudder's *utahensis*.

Big Stone, Waubay, Lake Oakwood, Brookings, Elk Point,

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[116] One of these, the new *Gryllus assimilis vernalis* Blatchley, is also a variant, not a geographic race, as an unqualified trinomial would imply. It is clearly very close to the *pennsylvanicus* variant of Burmeister. Blatchley and Hart find it distinguishable. The variants of the species are unstable and intergrade generally, their recognisable number, as a result, probably differing in the opinion of every student.

Vermilion, Yankton, Springfield, Hecla, Fairfax, Capa, Rosebud, Pine Ridge, Newell and Spearfish.

These three hundred and ten adults were taken from July 31 to October 4 The series, as is usual, shows great size and color variation Nine specimens only are macropterous This species is usually abundant in grasslands over its range, wherever there is a moderate amount of moisture

The present race is supplanted in the southeastern United States by the poorly defined *N fasciatus socius* Scudder and apparently in the more boreal spots on the northern Great Plains by *N fasciatus abortivus* Caudell

The northern limits of *fasciatus fasciatus* are Prince Edward Island, Algonquin Park, Ontario, Dugald and Aweme, Manitoba, and Billings, Montana It is apparently largely limited westward by the Rocky Mountains from Montana to New Mexico, but has been reported from Salt Lake City and Spring Lake, Utah In New Mexico it is known from Roswell and Albuquerque Its area of intergradation with *fasciatus socius* follows the fall line in the southeastern United States, thence westward passing through Tennessee, Arkansas and Oklahoma

Nemobius fasciatus abortivus Caudell

1904 *Nemobius fasciatus* var *abortivus* Caudell, Canadian Ent, XXXVI, p 248 [♂, ♀, Moose Jaw, Assiniboia (now Saskatchewan)]

1913 *Nemobius fasciatus abortivus* Hebard, Proc Acad Nat Sci Phila, 1913, p 427

Spearfish, August 31, 1924, 2 ♂, 7 ♀, (brachypterous)

We now have from Aweme, Manitoba, and Spearfish, South Dakota, both typical *fasciatus* and *fasciatus abortivus* Distinctly less boreal local areas, harboring the former, probably occur at these places The geographic racial status of *abortivus* would be invalidated, unless some such condition explains this situation More material of *fasciatus abortivus*, with definite data as to environment, must be secured to prove that it is not merely a local environmental adaptation, such as we know to be a brilliantly colored and more russet condition of typical *fasciatus* found in forest undergrowth of the east

The females of the present series have the ventral portions of the face black, this region paler in the males All are black in general coloration, but the females have the entire dorsal surface showing gray to varying degrees, in no case as general as is normal in

N griseus griseus Walker The females, however, but not the males, could easily be mistaken for very dark examples of that insect The following extremes are shown by these females, length of caudal femur 5 7 to 6 2, length of ovipositor 6 8 to 7 2 mm

This race is now known from Aweme and Elkhorn, Manitoba, Moosomin, Maryfield,[117] Yellow Grass, Moose Jaw and Vonda, Saskatchewan, Medecine Hat and Calgary, Alberta, Portal, North Dakota, and Spearfish, South Dakota

Nemobius carolinus carolinus Scudder

1877 *Nemobius carolinus* Scudder, Proc Boston Soc Nat Hist, XIX, p 36 [♂, ♀, North Carolina]

1913 *Nemobius carolinus carolinus* Hebard, Proc Acad Nat Sci Phila, 1913, p 36

Established synonyms of this race are *septentrionalis* Provancher, *exiguus* Blatchley, *affinis* Beutenmüller, *angusticollis* E M Walker and *janus* Kirby

Brookings, October 20, 1921, 1 ♀ Capa, September 13, 1921 2 ♀ Newell, August 31, 1922, 2 ♀

All of this material is typical and it is interesting to note that the Great Plains race, *N carolinus brevicaudus* Bruner also occurs at Capa, probably in quite a different local environment than typical *carolinus*, as there is no trace whatever of intergradation in that series The presence there of an almost typical Great Plains environment, as well as the river bottoms of Bad River, explains the occurrence of these very distinct races at the same locality

The present race is found over the entire eastern United States and southern Canada, its northern limits being Truro, Nova Scotia, the Temagami District, Ontario, Ann Arbor (previously unpublished) and Berrien County, Michigan, Madison, Wisconsin (previously unpublished), Minnesota, and Brookings, Capa and Newell, South Dakota Its western limits southward are South Bend, Nebraska, Clearwater, Kansas, and probably eastern Texas as far as the border of the more arid country Thence westward it is supplanted by the also very widely distributed *N carolinus neomexicanus* Scudder, which has a more southern distribution, and on the Great Plains by *N carolinus brevicaudus* Bruner

The race is liable to be found under debris of all kinds, but is usually partial to more humid areas, under dead leaves on the edge of forests It is usually common, though rarely as abundant as *N fasciatus* (DeGeer)

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[117] A macropterous male in the author's collection, taken August 31, 1916, by N Criddle

Nemobius carolinus brevicaudus Bruner

1904 *Nemobius brevicaudus* Bruner, Bull 94, Agr Exp Sta Colorado Agr Coll, p 57 [♂, ♀, Fort Collins, Colorado]

Capa, September 13, 1921, 1 ♂, 11 ♀.

The series is typical of the present race, being larger and much paler, with much shorter ovipositor (2 3 to 2 5 mm) than two females of *carolinus carolinus* (ovipositor 3 to 3 2 mm.) taken at the same locality

The present material, we feel certain, was taken in typical Great Plains environment, where so many of the species characteristic of that region were secured at Capa

This race is now known from other specimens taken at Fort Collins, Colorado, at the same time as the originally described series, and the material here recorded

OECANTHINAE

Oecanthus nigricornis (F Walker)

1869 *Oecanthus nigricornis* Walker, Cat Dermapt Saltat British Mus, I, p 93 [♀, Illinois.]

1915 *Oecanthus nigricornis* Fulton, New York Agr Exp Sta, Tech Bull 42, p 35

1920 *Oecanthus nigricornis* Severin, Office of [South Dakota] State Ent, Circular 19, p 1

This species has frequently appeared in the literature as *O fasciatus*, a name originating in a misidentification by Fitch In our opinion the more slender eastern *O quadripunctatus* Beutenmüller will be found to be distinct, but revisionary studies with very large series will be needed to prove this

Lake Hendricks, Brookings, Dell Rapids, Canton, Fairfax, Capa, Interior, Martin (sand hills), Newell, Whitewood and Hot Springs

Of this series, including one hundred and twenty-four individuals taken from August 5 to October 4, only part of the material from Lake Hendricks, Brookings and Canton has the limbs, median and lateral portions of the pronotum and the antennae darkened All of the others are pale yellow-green, the proximal antennal joints marked very heavily (as is typical in *nigricornis*) through sharply defined (as supposedly characteristic of *quadripunctatus*) to almost immaculate, having only a faint inner line or dot remaining. None, however, are as slender as the eastern *quadripunctatus*.

Material from Capa, Interior, Martin, Newell and Whitewood has the antennal markings very heavy and confluent and is probably *fasciatus* even should division of the series be necessary Specimens from Newell, Whitewood and Hot Springs have the clear cut distinct antennal markings, but twelve others from Martin have these markings almost obsolete

On the Atlantic Coast this species is known from Brunswick, Maine to Tinicum Island, Pennsylvania, but is found southward in the Appalachian Mountains to North Carolina and Tennessee It is abundant in Ohio, Indiana, Illinois, Iowa, and Minnesota Until the genus has been revised it would be unwise to attempt to give definite limits of distribution westward

The insect is usually found in weeds and low vines and shows a decided partiality to ovipositing in the canes of wild blackberry and raspberry.

Oecanthus niveus (DeGeer)

1773 *Gryllus niveus* DeGeer, Mém l'Hist Nat Ins , III, p 522, pl 43, fig 6 [♀ , Pennsylvania]
1920 *Oecanthus niveus* Morse, Proc Boston Soc Nat Hist , XXXV, p 404

Canton, August 26 and 27, 1923, 1 ♂, 1 ♀. Yankton, September 27, 1923 Capa, September 23, 1920, 2 ♀ Whitewood, September 10, 1923, 1 ♀

This insect is somewhat harmful to shrubbery and trees, doing particular damage in neglected orchards It is usually partial to cultivated areas

Known from the Atlantic to the Pacific, the records west of South Dakota, Nebraska, Kansas and Texas, are, however, widely scattered and some are probably due to introduction On the Atlantic Coast it has been recorded from Portland, Maine, to Cranberry, North Carolina, and Thompson's Mills, Georgia It is apparently unknown northwest of the South Dakota records here given, until the far west is reached, it being widely distributed on the Pacific Coast and reported from Penticton, British Columbia and North Yakima, Washington, to Los Angeles and Avalon, California Material is before us from the southwest, taken at the Bright Angel Trail in the Grand Canyon and Carr Canyon in the Huachuca Mountains, Arizona, and the Raton Mountains and Fort Wingate, New Mexico Its northern limits in the east are Lake Simcoe, Ontario, Benton Harbor, Michigan, and Minnesota.

Oecanthus angustipennis Fitch

1856 *Oecanthus angustipennis* Fitch, Trans New York State Agr Soc XVI, p 411 [♂, New York]
1910 *Oecanthus angustipennis* Allard, Proc Ent Soc Washington, XII, p 37
1915 *Oecanthus angustipennis* Fulton, New York Agr Exp Sta, Tech. Bull 42, p 27

Yankton, September 27, 1923, 5 ♀

Like the last species this insect inhabits shrubs and trees, where it sometimes does considerable damage ovipositing in the young shoots It is, however, less partial to cultivated areas and, in consequence, is probably of little importance from an economic point of view

On the Atlantic Coast it is known from Boston, Massachusetts, to Lakeland, Florida Its northern recorded limits westward are Washtenaw County, Michigan, Minnesota, and Yankton, South Dakota Thence southward its western limits are eastern Nebraska, Douglas County, Kansas, to Dallas and Columbus, Texas Its southern limits west of the Appalachians are poorly understood, it being reported only from Kentucky and Columbus, Texas

Oecanthus latipennis Riley

1881 *Oecanthus latipennis* Riley, U S Ent Comm, Bull 6, Gen Index, Ins Missouri, p 61 [♂, ♀, Missouri]
1915 *Oecanthus latipennis* Fulton, New York Agr Exp Sta, Tech Bull 42, p 41

Yankton, September 27, 1923, 3 ♂, 6 ♀ Fort Pierre, September 22, 1920, 1 ♀

This handsome species lives in trees, bushes, vines and tall weeds, but shows a very decided preference for oaks, particularly of the scrub type

It is known on the Atlantic Coast from Calverton, Long Island, New York, to Isle of Hope and Warm Springs, Georgia. The northern limits westward are Ohio, Michigan and Minnesota, that from Michigan being uncertain as Blatchley reports it as occurring only in southern Indiana. The southern limits are likewise indefinite, being Alabama, Missouri and Lawrence, Kansas (previously unpublished) Westward the reported limits to the north are eastern Nebraska and Fort Pierre, South Dakota.[118]

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[118] Records of this insect from the southwestern United States are probably all referable to a related, though amply distinct, species

MYRMECOPHILINAE

The diminutive *Myrmecophila pergandei* Bruner is known from the central eastern United States to Omaha and South Bend, Nebraska It may, therefore, occur in southeastern South Dakota The species has been found in the nests of ants of the following genera *Crematogaster*, *Aphaenogaster*, *Lasius*, *Formica* and *Camponotus*

The still smaller, banded *Myrmecophila nebrascensis* Lugger, occurs from southeastern Arizona and central Texas to West Point and Weeping Water, Nebraska, and possibly Minnesota. It may, therefore, occur in southern South Dakota, though as yet not known from the state The species has been found in the nests of ants belonging to the following genera, *Pachycondyla*, *Pheidole*, *Crematogaster*, *Pogonomyrmex*, *Liometopum*, *Tapinoma*, *Dorymyrmex*, *Iridomyrmex* and *Formica* An established synonym is *Myrmecophila nehawkae* Scudder

MOGOPLISTINAE

The diminutive *Cycloptilum squamosum* Scudder is known northward to Lincoln, Valentine and Sidney, Nebraska, and is almost sure to be found in the more arid southern portions of South Dakota, in which state it has not yet been secured Beating dry brush is usually the most successful method of taking material The species is nocturnal and, though its tinkling stridulation may be heard on all sides at night in some localities, capture of even a few specimens is often a difficult matter An established synonym is *Cycloptilum boreale* Bruner

TRIGONIDIINAE

Anaxipha exigua (Say)

1825 *Acheta exigua* Say, Jour Acad Nat Sci Philadelphia, IV, p 309 [♂, eighty miles west of Kansas City on the Missouri River, Kansas]
1920 *Anaxipha exigua* Blatchley Orth of North-Eastern America, p 730

This species has been recorded as *A pulicaria* (Burmeister),[119] the genotype, a species now known to be widely distributed in the American tropics

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[119] From additional material we now believe that *A. pulicaria* (Burmeister) is the insect we recorded from the United States as *A vittata* (Bolivar) in 1916, and that the species we then recorded as *pulicaria* must be placed as *A delicatula* (Scudder) See Hebard, Proc Acad Nat Sci Phila., LXXVI, p 232, (1924).

Elk Point, September 8, 1924, 1 ♂, 1 ♀ Yankton, August 30, 1923, 1 ♀, and September 27, 1923, 1 ♀

All of these specimens are brachypterous This handsome little species is usually found in luxuriant grasses or weedy tangles, or low in bushes, particularly near water It is often locally abundant It is a truly thamnophilous insect, rarely seeking the ground

The species is found locally over the entire eastern United States except peninsular Florida, as far north as Westbrook, Connecticut, Staten Island, New York, Pottstown, Pennsylvania, Kosciusco and Fulton County, Indiana, the Mississippi River in Minnesota, and the localities given above To the south its western distribution reaches Cuming County, Nebraska and probably the western limits of the more humid regions to the Gulf Coast, where it extends southwestward as far as Brownsville, Texas.

GRYLLOTALPINAE

The common American Mole Cricket, *Gryllotalpa hexadactyla* Perty, is known from Minnesota and eastern Nebraska Its distribution is largely co-extensive with that of *Ellipes minuta* (Scudder), but reaches even further into the temperate regions It is, therefore, almost certain to be found in South Dakota, though probably there uncommon The insect is often difficult to locate as it spends almost all of its life underground.

Established synonyms are *borealis* Burmeister, *brevipennis* Serville, *asteca* Saussure, *longipennis* Scudder and *columbia* Scudder.

TRIDCTYLIANAE

The larger Pygmy Mole Cricket, *Tridactylus apicialis* Say has a distribution closely similar to that of *Gryllotalpa hexadactyla* Perty. It has been reported from Fort Snelling, Minnesota, and as occasionally found in southern Nebraska It reaches further north than *Ellipes minuta* (Scudder), being known from the Humber River and York Mills, Ontario, and may therefore very possibly be found in southeastern South Dakota. Though of similar habits to that species and likewise sometimes found in enormous numbers, this species is very rare and local in many portions of its range in the United States

Ellipes minuta (Scudder)

1862 *T[ridactylus] minutus* Scudder, Boston Jour Nat Hist, VII, p
425 [♂, southern Illinois.]
1920 *Ellipes minuta* Blatchley, Orth of North-Eastern America, p 658

Established synonyms of this species are Saussure's *Tridactylus histrionicus* and *histrio*

Brookings, June 12, 1923, 1 ♀ Canton, August 27, 1923, 2 ♂, 2 ♀, 4 juv Pierre, August 5, 1919, 2 juv

The five adults are, as is usual, brachypterous The species lives on bare damp soil in the immediate vicinity of water Its small size and astounding saltatorial power make it almost impossible to capture except by sweeping with a net

The known northern limits of the species are Ocean City, New Jersey, Chestnut Hill, Pennsylvania[130], Cedar Point, Ohio, Warren Woods, Michigan, and Brookings, South Dakota In the more arid western United States its distribution is much more discontinuous than in the east, and the published northern limits fall much to the south, being Brownsville, Texas, Douglas, Arizona, and Cottonwood and Palm Springs, California, in the latter state reaching north in the San Joaquin Valley to Ahwahnee Over the tropics of America *minuta* is widely distributed and reaches as far southward as the Argentine Republic

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[130] A large series was secured by the author May 13 and 29, 1903, on the boulder strewn margins of the Wissahickon Creek, where the species was locally abundant

NORTH AMERICAN VERONICELLIDAE

BY H BURRINGTON BAKER

This paper is mainly based on material in the Academy of Natural Sciences of Philadelphia from the mainland of North America and the West Indian Islands, unless specifically stated otherwise, the numbers given in the lists of specimens are catalog numbers of this Academy I am deeply indebted to Dr Henry A Pilsbry for permission to examine this material, and to both him and Mr E G Vanatta for constant assistance and advice Dr T D A Cockerell also generously sent me some of his Jamaican material of *Veronicella sloanii*, while Dr William Healey Dall contributed the actual type of his *bahamensis* for examination

In a recent paper (1925, Naut , XXXIX, 13–18), the nomenclature of the proposed groups in this family has been discussed, although without reference to their systematic rank The present study recognizes two quite definite genera, with at least ten rather certain and two doubtful species, within the limits of North America

In the following key, which may assist in their separation, color patterns are sometimes included, but warning is given that, although large lots of a single species usually show certain characteristic trends, any attempt to identify individuals on external characters alone is absolutely futile!

All of the North American species have the intestinal loops imbedded in the liver, the pedal nerves are usually in contact for some distance, and the verge is acrocaul or nearly so and does not develop a definite annular thickening Throughout the paper, *Ve* is used as an abbreviation for *Veronicella*, *Vs* for *Vaginulus*, and *Va* for *Vaginula*

KEY TO GENERA, SUBGENERA, AND SPECIES

A′ Oval anus protected ventrally by an anterior flap so that the superficial opening is a transverse crescentic slit which usually extends beyond right edge of retracted foot, dorsum usually with two longitudinal dark bands, spermathecal stalk elongate and cylindrical, joined by canalis junctor which enters near base of terminal sac, female opening posterior to middle, hindgut and genitalia enter body wall in close juxtaposition, verge simply cylindrical or with

subspiral ridges, acrocaul or practically so, but with orifice surrounded by a granulate, chalky-white glans, retractor short and stout, dart-papilla small with paired retractors. Bermuda to Jamaica and Porto Rico, Mexico to Nicaragua
Subgenus *Veronicella* Blainv., s s

B′ Dorsum with or without dark bands which, when present, are separated by about ⅓ width of animal and are most evident in immature specimens, *vagina without accessory bursa*, spermathecal stalk hard and polished, looped back and forth beneath vas deferens, verge elongate and quite simply cylindrical, with strictly apical orifice, viviparous (?) Bermuda, Jamaica (Cuba ?)
Section *Veronicella* s s.

C′ Longitudinal dark bands distinct, even in most adults, Bermuda, higher altitudes in Jamaica
Ve sloanii schivelyae (Pils.)

C″ Longitudinal dark bands usually absent, Jamaica.
Ve sloanii sloanii (Cuvier)

B″ Dorsum with or without dark bands which are separated by at least ¼ width of animal and, when present, are quite evident in all stages of maturity, *vagina with large accessory bursa;* spermathecal stalk softer in texture and often spirally coiled, verge with spiral or subspiral ridges Florida to Jamaica and Porto Rico, Mexico to Nicaragua
Section *Leidyula* new

D′ Hyponotum usually light, unicolor, verge with subspiral ridges which are close together on orificial side at glans but diverge as they pass proximad, seminal orifice subapical

E′ Dorsum with dark, or without dorsomedian stripe, with dark bands narrower, weaker and more widely separated; female opening usually more than ¼ hyponotal width from foot, verge shorter with larger glans and distinctly lateral orifice, and with weaker lateral ridges rapidly divergent and joined so as to form a transverse loop just beyond apical ⅓, viviparous Mexico to Nicaragua
Ve moreleti (C. & F).

E″ Dorsum with light, dorsomedian stripe, with dark bands usually broad and distinct, female opening usually less than ¼ hyponotal width from foot, verge larger and more elongate, with small glans usually bent back so orifice is almost terminal, and with prominent lateral ridges that separate gradually without confluence and extend beyond apical ⅓ of organ; oviparous Southern Florida to Jamaica (Haiti?), the type-species. *Ve floridana* (Leidy).

D″ Hyponotum usually dappled with vague gray spots, dorsum with light dorsomedian stripe but with longitudinal dark bands narrow or quite obliterated by general infuscation, verge with large glans, practically apical orifice and two fine spiral ridges which pass almost completely around its apical half. Jamaica to Porto Rico (Cuba?). *Ve. kraussii* (Fér.)?

A″ Roundish anus almost median, usually protected ventrally by a dextral flap, so that superficial crescentic slit is more or less longitudinal and usually hidden under end of even retracted foot, spermathecal stalk short and usually swollen, canalis junctor enters spermathecal sac some distance from stalk, verge without granulate, chalky-white glans. South America to Mexico and Jamaica (in America). Genus *Vaginulus* Férussac

F′ Female opening usually posterior to middle, hindgut and oviduct enter body wall in close juxtaposition. South America to Guatemala and Jamaica. Subgenus *Angustipes* Colosi

G′ Verge long and cylindrical, quite symmetrical except at apex, canalis junctor enters apex of spermathecal sac (in our species, verge and dart each with a single long slender retractor). Jamaica and Guatemala to South America. Section *Latipes* Colosi

H′ Animal less than 60 mm. long (?)

I′ Female opening posterior to middle of length. Mainland forms

K′ Hyponotum with large black spots, tip of verge with papillae (all?) and with prominent, reflected emarginate cap (glans) which hides the pseudacrocaul opening. Porto Rico through northern South America to Guatemala.

Vs. occidentalis (Gldg.).

K″ Hyponotum unicolor, verge almost acrocaul, tip entire without papillae. Central America (and?).

Vs. olivaceus (Stearns).

I″ Female opening anterior to middle of length (?), dorsum without dorsomedian light band, hyponotum with grayish markings near center of each side; verge with enlarged apex and simple, slightly reflected cap. Jamaica.

Vs. nesiotis Simroth

H″ Animal more than 60 mm long, no hyponotal spots or dorsomedian stripe mentioned St Lucia
Vs luciae (Cockerell)

G″ Verge short and stout, usually asymmetrical, canalis junctor enters near base of spermathecal sac.
Section *Angustipes* Colosi

L′ Female orifice near middle of hyponotal width, dorsum with groups of small dark dots, which form vague longitudinal bands either side of the dorsmedian light stripe, tubules of dart-gland very short and few (6–8), verge swollen apically and tapered towards base, flattened at right angles to lateral ridges St Thomas and Antigua
Vs dubius Semper

L″ Female orifice near pedal groove, dorsum with scattered large black spots which may extend onto hyponotum, dorsomedian light stripe weak, tubules of dart gland long and more numerous, verge swollen basally and tapered towards apex, obese Santo Domingo
Vs bürgeri Simroth

F″ Female opening anterior to middle, hindgut and oviduct separated South America and Mexico
Subgenus *Vaginulus* s.s

M′ Dorsum usually with two, longitudinal dark bands which bound a dorso-median light zone, verge with accessory spathe South America and Mexico
Section *Phyllocaulis* Colosi

N′ Longitudinal bands indistinct, verge shorter and more conical, spathe large enough to enclose it, pedal nerves immediately divergent Chile and Mexico (introduced?)
Vs gayi Fischer
Vs decipiens Semper.

N″ Longitudinal bands distinct; verge long and slender, spathe not large enough to enclose it; pedal nerves divergent at ⅔ body length Mexico. *Vs strebelii* Semper

Veronicella sloanii schivelyae (Pilsbry) Plate III, figures 1–4

?*Va sloanei* Fischer (1871, Nouv Arch Hist Nat Paris VII, 166, pl XI, 1), Bahia-Honda, Cuba

Vs schivelyae Pils. (1890, P A. N S P, 297, pl V, 6–8; 1891, Naut V, 39, pl II, 6–8), Public Gardens at St George, Bermuda

Ve virgata Ckll (1892, Jour Inst Jam I, 96), Port Henderson, Jamaica, Ckll (1893, Conch II, 219), Moneague, Jamaica, Ckll & Larkin (1894, J Mal III, 23), var of *sloanii*

BERMUDA. No 60964 one adult, the type (Heilprin Expedition, 1888). No 85556, three adults from flats near Frascati Hotel (Gulick, 1903), very rigidly fixed, Plate III, fig 4 No 98631 numerous specimens in various stages of immaturity, from Harrington House, Hamilton Parish (Brown, June, 1909), Plate III, figs 1, 2, 3. No. 94802 six young specimens from same locality as 98631 (Brown, Feb , 1908)

JAMAICA No 62131 one medium-sized animal from Port Antonio (Fox, 1891) No 71909 one very small specimen labeled *virgata*, from Moneague (Ckll)

The general coloration of slightly immature individuals of this subspecies resembles that in Fischer's figure, although the longitudinal bands are narrower in Bermudan specimens Pilsbry's description and figures give the color pattern of rather lightly-pigmented adults. This form with the prominent longitudinal dark bands, which are usually evident even in the very large adults from Bermuda, appears to be rare in Jamaica, nevertheless, I suspect that it was artificially introduced into the more northern British colony

In the following table of measurements (and throughout paper) lengths and widths are major dimensions (in millimeters), under the width of the animal, that of the sole, and the distance of the female opening from the anterior end, the index (obtained by dividing each dimension by the length) is followed by the actual measurement (in parentheses) The distance of the female opening from the pedal groove (foot) is usually expressed as a percentage of the total width of the hypnotum with its reciprocal ("Querindex" of Hoffmann) in parentheses, in a few cases cited from other authors, the actual distance in millimeters is necessarily substituted

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
schwelyae (Pils)	65	28(18)	10(6 5)	55(35 5)	25(4)
	68	24(16)	10(7)	55(37 5)	22(4 5)
virgata (Ckll)	50			56(28)	0 5 mm
No 85556, fig 4	61 5	34(21)	15(9)	58(36)	20(5)
No 98631, figs 1, 2	55 5	28(15 5)	9(4 8)	55(30 5)	17(6)
fig 3	59	26(15 5)	8(4 7)	57(33 5)	19(5 4)

As originally planned, this paper dealt simply with the Bermudan and mainland species, and the first three plates were finished before the West Indian material in the Academy of Natural Sciences of Philadelphia had been examined This was the reason for the detailed description of the subspecies instead of the typical form.

In general form, the pallial complex (Plate III, fig 3) resembles most that shown by Sarasin (1899, Land-Moll Celebes, pl XIV, 127) for *Va djiloloensis* (genus *Semperula*) Kidney. flattened, roughly lanceolate with a tongue-shaped prolongation which extends along right side of pericardium to beyond anterior border of latter; abruptly broadened beneath posterior end of heart, extends ventrad to coils of ureter as far as their posterior ends, which are some distance posteriad to entrance of hindgut into body wall Ureter arms subequal in length (about half that of kidney), with diverticular prolongations at loops; last arm larger in diameter, venate like lung and with glandular thickenings along its dorsal and dextral sides Lung elongate cylindrical, almost twice diameter of hindgut and with short prolongation posterior to its opening into latter; about 1¼ times as long as kidney, walls with numerous large, transverse tributaries to posterior vena cava The rich venation of this lung certainly gives it every appearance of an organ for aeration, although it is possible that its function is simply the return of water to the circulation (an apparent feature in most land molluscs). Anus extends more noticeably dextrad to the foot (see key to species) than in *V floridana* or *V moreleti* Heart ventricle roughly conical, auricle sickle-shaped; anterior arm of latter receives a vein from integument while posterior vena cava lies between lung and hindgut, runs beneath the ureters above the kidney, and empties into posterior arm

Before beginning the description of the genitalia, a few general remarks may be in order In the first place, practically all of the forms examined appear to be protandrous, at least, the male organs and spermatheca (bursa copulatrix or receptaculum seminalis) may be quite mature while the female organs are still rather rudimentary Also, from the rather scanty evidence, I am inclined to believe that these slugs attain sexual maturity at certain seasons (apparently during the period of greatest rainfall in Venezuela and Mexico) more or less regardless of their size Finally, attention is called to the use of *penis*, throughout this paper, for the entire male copulatory organ, while the term *verge* (oncheiopodium) is adopted for the highly-developed penial papilla, this usage appears to be that most in conformity with the well-established nomenclature in the Stylommatophora and was used by many of the earlier writers on the Basommatophora.

Ovisperm duct (Plate III, fig 1) heavier and coarsely convoluted towards its anterior end, constricted slightly where it passes into the next. Spermoviduct a rather short, cylindrical, looped, thick-walled tube which gives off the short and slender oviducal link and is continued as vas deferens Albumen gland large and massive in mature specimens (although less so than in *V moreleti*) Uterus looped under prostate and coiled in a long, double spiral anteriad to latter, becomes very bulky in mature specimens, joins spermathecal stalk near body wall I do not find any proof of ovoviviparity in my specimens, but Cockerell and Larkin (1894, 29) have stated that this is apparently the method of reproduction in the typical subspecies, as it certainly is in *V moreleti* (see below) Spermatheca stalk exceedingly long and slender, thick-walled and so firm in texture as to appear glossy, thrown into two or three coarse loops under end of uterus and vas deferens, terminal sac greatly distended in some mature specimens but apparently always roughly kidney-shaped with opening of stalk near center of concave side Vagina ovoid, somewhat swollen, without trace of accessory bursa, even in mature specimens

Vas deferens receives prostatic duct (prostate relatively small in mature specimens) and soon divides, canalis junctor very much shorter than bursal stalk, enlarged slightly where it joins latter close to base of bursal sac, remainder of first free portion somewhat convoluted, slenderer than canalis but about as long, second free portion ventrad to dart sac, convoluted. Dart sac (Plate III, figs 2, 4) papilla small, conical, and with apical orifice, gland tubules (38 counted, with at least 5 cases of bifurcation) relatively short, even in mature specimens, retractors double, variously branched at origin and insertion, arising from body wall on opposite sides of verge retractor and inserting on short sheath which encloses bases of tubules Verge elongate, cylindrical, slightly enlarged near apex, tip formed by a symmetrical, perforate glans (absent or rudimentary in very young animals) that contains spherical, chalky concretions which give it a dull white color, vas deferens continued as a slender central duct which is apparently free from surrounding walls throughout its length, although both are attached to glans, seminal orifice strictly apical. Verge retractor short and stout, origin close against anterior pericardial wall, insertion surrounding base of verge. In an adult specimen (Plate III, fig 4), the retractor of the verge consists of three, easily separable bundles, two of which sheathe the end of the vas deferens, but in an immature specimen (fig 2), no distinct divisions could be made out

The pedal nerves diverge at about the level of the heart, i e., around end of apical ⅓ of body length

Veronicella sloanii sloanii (Cuvier) Plate III, figures 5, 6

Limax nudus cinereus terrestris Sloane (1725, Hist Jam., II, 190, pl CCXXXIII, 2, 3), Jamaica

Onchidium sloanii Cuvier (1816, Reg An, II, 411), Jamaica

Vs sloanii Johnson & Fox (1891, Naut , V, 34), Port Antonio, Jamaica
Ve sloanii Ckll (1893, 217), Ckll & L (1894, 23), Kingston, Jamaica
Ve sloanei Henderson (1894, Naut , VIII, 21), Mandeville, Jamaica
Ve laevis Blainville (1817, Jour phys , LXXXV, 442, pl II–IV), habitat unknown to its author but actually Jamaica, Gray (1847, P Z S , XV, 178), as synonym with *Limax nudus* Sloane
Ve sloanii coffeae Ckll (1893a, Naut , VI, 128, 1893, 218), Brokenhurst, Mandeville, Jamaica, dark race
Va sloanii maculatus and *subpallida* "Ckll " Vendryes (1899, Jour Inst Jam , II, 601), nude names, Ckll (1900, Naut , XIII, 131), described in *Ve*
Cylindrocaulus olivaceus jamaicensis (1925, Jena Zeitschr , LXI, 152, 233, part of synonymy)

Jamaica No 62131 one adult from Port Antonio (Fox, 1891) No 65396 six adults (Henderson, 1894) Nos 71904–8 seven somewhat immature animals from Kingston (Ckll), also seven specimens sent me by Dr Cockerell himself, Plate III, figs 5, 6

United States, introduced No 69360 one small (40 mm long) but almost mature specimen fixed in chromic acid (which gives it consistency of rotten rubber) from Nantucket, Mass (B Sharp, Aug , 1896, on bananas), indentification fairly certain

As I indicated in a former paper (1925, 17), it seems best to accept the equivalence of *Ve laevis* and *Onchidium sloanii*, and to use the older name, although Cuvier founded it by the incorrect citation of an almost unrecognizable figure The present species certainly appears to be the most abundant Veronicellid in Jamaica, although *Ve kraussii*, *Ve floridana* and *Vs* (*Latipes*) *nesiotis* are also found there The first two also belong in the subgenus *Veronicella* s s , and I am inclined to believe that the last two have been artificially introduced, plausibly since Sloane's time The specific identity of *sloanii* and *laevis* will always be open to query, but the application of the generic name is beyond reasonable doubt, although two centuries have elapsed since Sloane, the only authentic Jamaican record for any other group (*Latipes*) is based on a single specimen!

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
sloanii (Sloane)	88 9 (living)				
laevis (Ckll), type	50	35(17 5)	14(7)	58(29)	2 mm
coffeae (Ckll), alive	82 5	37(31)			
alc	65	32(21)	12(8)	51(33)	2 mm
sloanii (Ckll & L), large	71	31(22)	13(9)	54(38)	2 5 mm
sloanii, my Pl III, fig 5	37 5	31(11 5)	10(3 8)	60(22)	25(4)
my Pl III, fig 6	36 7	30(11)	11(3 9)	56(20 7)	25(4)
No 65396, largest	bent	(31)	(9 8)		20(5)
another	61	36(22)	12(7 2)	54(33)	23(4 3)

The main difference between *sloanii* and *schivelyae* is the lack of dark longitudinal bands in even quite immature Jamaican specimens In position of anus, level of divergence of pedal nerves, absence of vaginal accessory bursa, type of spermatheca (Plate III, fig 6) and form of verge (Plate III, fig 5), *sloanii* agrees fundamentally with *schivelyae* However, from Cockerell and Larkin's analysis as well as from specimens before me, it appears that the former commonly attains sexual maturity when smaller and usually has the female opening a little farther away from the pedal groove The specimens figured by me are not fully mature, but, despite their smaller size (see table) they are somewhat more so than those of *schivelyae* which are also figured (Plate III, figs 1, 2, 4) In addition, the spermathecal sac is usually almost spherical in *sloanii* and the canalis junctor commonly enters the walls of the stalk some distance below it (approaching *Leidyula*), the glans of the verge tends to form a papilla around the seminal orifice, and the origin of the verge-retractor is commonly bifid where it joins the body wall at the anterior edge of the pericardium Very slight traces of lateral ridges (due to compression?) are sometimes just visible near the base of the glans The gland-tubules are usually even shorter than in specimens of *schivelyae* at the same stage of sexual maturity

Veronicella (Leidyula) moreleti (Crosse & Fischer) Plate IV, figures 7–11

?*Vs floridanus* Tate (1870, Amer J C V, 158), Javate, Chontales and Toro Rapids, Nicaragua (Gulf slope)
?*Cylindrocaulus floridanus* Hffm (1925, 236), San José, Guatemala, Tepic, Mexico
Va moreleti C & F (1872, J de C, XX, 59, 1878, Moll Terr Fluv Mex I, 682, pls XXIV, 14, XXIX, 6–14), Palenque, Tabasco (type locality), Carmen and Cacoprieto, Tehuantepec (all Mexico), H B B (1923, Occ P Mus Zool Univ Mich, no 135, 16), Hacienda Cuatotolapam, southern Vera Cruz
Vs moreleti Pils (1919, P A N S P, 219), Jocolo and Esmeralda Plantation, Guat
Vs mexicanus Strebel and Pfeffer (1882, Beitr Kennt Mex, V, 130, pl XIX, 1–19, 21, 23, 26, 27), probably eastern Mexico
Va mexicana Semper (1885, Reis Arch Phil II–III, 316, pl XXVII, 17), Vera Cruz, Mexico, Simroth (1913, Mém Soc Neuchat V, 292, pl XII, 29, 30)
?*Ve* sp nov vel *mexicana* var Ckll (1895, Naut, VIII, 142), Honduras
?*Ve* sp ? Hinkley (1907, Naut, XXI, 78), Valles, Mex
?*Ve mexicana betheli* Ckll (1913, Naut XXVII, 1), Puerto Barrios, Guat

MEXICO No 63109 one almost mature animal from Tabasco, dart-glands long No 98332, one immature specimen from Mecos (Hinkley); verge with undeveloped glans and fold like that described by Srth. No. 133651 seven sexually mature animals from

Hacienda Cuatotolapam (H. Burrington Baker, July–Aug, 1910), Plate IV, figs 7–11, living animals either olive drab or distinctly reddish brown

GUATEMALA No 45188 three immature specimens from Jocolo (Hinkley, Feb, 1917), in largest, verge well developed and dart glands very long No 45189 two very small specimens from Esmeralda Plantation, Rio Dulce (Hinkley, Jan., 1917), coloration typical. No 45190, four young animals (Hinkley), glans of verge poorly developed No 45670, three young individuals from Livingston (Hinkley)

Crosse and Fischer's figures of the anatomy and external form of this species give a fairly accurate idea of mature individuals, although they deny the presence of a canalis junctor and describe the length of the dart-glands as they would appear in immature animals or in those past the climax of their male sexual activity Strebel's material certainly suffered from a plethora of investigators, three eminent anatomists based their work on it, and the results, even after the exclusion of Pfeffer's more obvious misconceptions, present an interesting commentary on individual variation Simroth's figures of both verge and posterior genitalia are quite correct for young animals of this species, and it seems probable that all of the descriptions of *V mexicana* were founded on specimens in varying degrees of maturity The necessity for Cockerell's Guatemalan subspecies seems very doubtful, although future examination of large series of adults may determine its validity

In the material dissected by me, sexually mature individuals vary from 40 5 to 60 2 mm in length This species is certainly ovoviviparous, one specimen 44 5 mm. long contains 35 perfectly formed young, which vary between 9 8 and 5.7 mm in length Although light-colored, these show distinctly the two, widely-spaced dark bands, that are characteristic of the species The uterus of the mother is distended so that it extends from above the pharynx to near the posterior end of the body cavity, although the other organs are flattened by the resultant pressure, they appear quite normal in arrangement The albumen gland is reduced in size and the intervals between the unattached embryos are packed with material that resembles its normal contents. The combined bulk of the fetal animals is about half that of the stripped parent.

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
moreleti (C & F)	90 (living)			50±	
mexicanus (S & P)	47			50±	
mexicana (Smpr)	20	35(7)	10(2)	55(11)	near
133651, largest	60 2	33(21)	16(10)	53(33)	29(3 5)
figs 7-11	45	43(19 5)	18(8 2)	54(24 2)	29(3 5)
pregnant	44 5	41(18 3)	18(7 9)	56(25)	30(3 3)

Pallial complex very similar to that of *V sloanii schivelyae;* in my specimens, venation of lung partially obscured by longitudinal plications Anus not so prominently dextral as in preceding species, but usually visible beyond retracted foot

The genitalia agree in most particulars with those of *V sloanii* Spermoviduct (Plate IV, fig 11) rather long, sharply demarcated from ovisperm duct Albumen gland enormous in mature specimens, composed of disc-shaped lobes, duct empties into head of uterus along with short oviducal link Uterus greatly convoluted, thin walled, fully half is looped back and forth along sides of albumen gland, so that loop in double spiral (mainly unwound in fig 11) is relatively shorter Spermatheca somewhat similar to that of *sloanii*, but stalk, which is much softer in texture, is usually retracted (Pl IV, fig 11) or spirally coiled (C & F) Canalis junctor free portion very short, curved back on itself and enlarged near junction with spermathecal stalk near base of latter As in *V floridana* (fig 12), the lumen of the canalis runs up through the walls of the stalk so that the actual confluence is just below the terminal sac Vagina with rather large, ovoid, accessory bursa which is evident even in immature specimens and is smaller but similar in structure to that of *V floridana*

Dart sac (Plate IV, fig 9) gland tubules (32 to 49 counted, most numerous in largest animals) attaining about half length of animal, papilla (Plate IV, fig 8), elongate mammiliform Verge (Plate IV, figs 7, 10) short and stout, glans asymmetrical with opening slightly to one side of apex, two low ridges begin close together at base of glans on orificial side, but rapidly diverge and finally join to form a transverse fold just beyond apical third of entire organ The left ridge (as viewed from orificial side) is stronger and often continues slightly beyond the transverse portion so as to form a dextral spiral In immature specimens, the glans is absent or poorly developed and the portion of the verge distad to the transverse fold may be constricted, so as to look much like Simroth's figure Verge retractor short, stout and apparently entire, origin about 6 mm in front of pericardium The pedal nerves diverge behind the level of the heart near the middle of the animal (Cf C. & F).

Veronicella (Leidyula) floridana (Leidy) Plate IV, figures 12–14.

?*Onchidium cubense* Pfr (1840, Arch Nat , VI-I, 250), El Tumbadero, Canimar R , Cuba, also Cuban records of *occidentalis* (see *V. krausii*)?

Va sloanii Orb (1845, Sagra, V, 72), Cuba

Vs sloanei Arango (1865, Cat Mol Cuba, 136, 1878, Cont Mal Cuba, 129), Cuba
Va sloanei Fischer (1871 166), probably most of Cuban records
Vs sloanii Gibbons (1879, J of C, II, 132), Habana, Cuba
Va sloanei? Smpr (1885, 297 pls XXIV, 2, XXVI, 5), Cuba, Jamaica
Belocaulus sloanei Hffm (1925, 202, 249, pl VI, 45h 6), Matanzas, Cuba, Dondon, Haiti (includes *V kraussii*)
Vs floridanus Leidy (1851, Binn Terr Moll, I, 198, 251, pl IV), anatomy, Binney-Gould (op cit, vol II, 17, pl LXVII), exterior, Charlotte Harbor, west Florida
Ve floridana Tryon (1868, Amer J C, III, 317, pl XVII, 2–5), W G B (1885, Bull U S Nat Mus, no 28,447), Punta Rassa and southern Keys, Fla
Va floridana Srth (1913, 300), Tampa Bay, Fla
?*Cylindrocaulus floridanus* Hffm (1925, 142,235, exclusive of synonymy and description!), Nassau, "Feuersee" (New Providence I), Bahamas
?*Ve schivelyae bahamensis* Dall (1905 Smith Misc Coll, XLVII, 446, pl LIX, 1) Johnson's Place Nassau (New Providence I, type locality) and Nield's Place (Little Abaco I), Bahamas, Robbins & Ckll (1909, Proc U S Nat Mus XXXVI, 383, pl XXXII, 7 8)

FLORIDA No 57953 two specimens (J W Velie) No 63528, eight sexually mature animals from Key Largo (H C Machette); Plate IV, figs 12–14) No 63941 one juvenile from Cape Romano No 79830 six large but sexually immature specimens from Miami (Pilsbry, 1899) No 85610 eight animals in various stages of immaturity from Miami (Rhoads, 1899) No 91399 one lightly pigmented specimen from Mound Key, Estero Bay, Lee Co (C B, Moore) No 93280 one animal from Sugarloaf Key (Pils, 1907).

BAHAMAS One immature, bleached specimen, the type of *bahamensis*, generously lent me by Dr Dall No 57969 one bleached juvenile, from Nassau Harbor, New Providence I, unidentifiable, but with traces of characteristic bands

CUBA Smithsonian Institution no 36484, numerous juveniles from El Guamo (Palmer and Riley, Mar 24, 1900, under rocks), identified simply by coloration *Habana Prov* No 74362, twelve specimens not quite sexually mature, from Marianao (Rhoads, 1899) No 137811 five individuals from La Salud, under stones (Pilsbry, Apr 22, 1904) *Matanzas Prov.* No. 137809 seven specimens from under stones in grass at low elevation within eastern rim of Yumuri Valley, and at escarpment on southeast side of Matanzas valley near Matanzas (Pils., Apr 16–17), within a few miles of the type locality of *cubense* *Santa Clara Prov* No 137803 very numerous (50+) animals in various stages of maturity from under old ties in Tunas á Sancti Spiritus Ferrocarril yard at Sancti Spiritus ("Of two colors, blackish and reddish," Pilsbry, Apr 12) No 137804 five specimens from La Vigia, near Trinidad (April 5, Pils) No 137805 four adults from San Juan de Letrán near Trinidad (same date) No 137806 one adult from Trinidad (same date) No 137807 one very obese individual from dissected limestone ridge, locally called San José, about 2 5 km northeast of Sancti Spiritus (Pils, Apr 11) No 137808. two animals from Lagunilla near Cienfuegos, under large stones in pairs (Pils, Mar. 31) No 137812 nine variously mature specimens from same locality at same date No 137813 two animals from 15 km out of Sancti Spiritus (Pils, Apr 11) No. 137814 six examples from Zaza del Medio (Pils, Apr 15) *Camaguey Prov* No. 137810 seven animals in various stages of maturity from Majagua ("under a large stone," Pils, Apr 13) *Isle of Pines* No 117082 three young animals from Nueva Gerona (Soelner, July 18, 1907), identification doubtful

JAMAICA No 137833 one somewhat immature but perfectly identifiable animal in a lot of *V sloanii* (J B Henderson, 1894), rather lightly pigmented but with typical color pattern

The description of *Onchidium cubense*, without figure or anatomy, is completely unrecognizable, its confusion with *V occidentalis* suggests *V kraussii* (see below) However, it must be admitted that the present species is the only one recorded with certainty from Cuba, so that the type locality of Pfeiffer's name may force its ultimate use instead of *V floridana*

Semper's figure of the penis and its accessories, tentatively identified as *Va sloanei*, gives an excellent idea of the retracted verge, but he apparently did not examine the female genitalia Hoffmann follows his identification and must have dissected out the spermatheca, but completely overlooks the enormous vaginal pouch

Although Leidy apparently did not save the type specimens, his remarkably accurate and detailed definition, from a slightly immature animal, makes this the first thoroughly recognizable species in the genus, while Binney's figure represents the quite constant coloration and form of Floridan specimens I cannot imagine any possible basis for Hoffmann's *C floridanus*, he places both *schivelyae* and *moreleti* in its synonymy, his description of its canalis junctor and spermatheca (p. 235) agrees with none of the species of *Veronicella;* his truly artistic diagram of its verge (pl V–45d, 3, locality?) defies identification, and he classifies its approximately correct definition (*Belocaulus sloanei*) in a different "subfamily"!

Dr Dall very generously allowed me to dissect the type specimen of his *bahamensis* This animal is very immature, the female organs form a nodule (about twice the diameter of the hindgut) at the base of the ovisperm duct, and the connections of the spermatheca, vas deferens and uterus are inside of the slit in the body wall However, the connection of the canalis junctor, the presence of a vaginal accessory bursa, the verge-retractor and its origin, and the divergence of the pedal nerves, all agree with *V floridana*, although the position of the female opening is similar to that in *V moreleti* The exact anatomical definition of *V floridana bahamensis*, either as a subspecies or a species, must await the examination of adult material

Although the coloration of Floridan specimens appears rather constant, that of Cuban examples is extremely variable Besides the two types of general coloration, noted by Dr Pilsbry from living animals, the specimens in alcohol show three general trends in color pattern The typical form, with two quite distinct black bands (See Binney's or Semper's figures) is present in almost all localities, the single specimen from Jamaica is also of this type Another form, which is almost as prevalent and approximates Pfeiffer's descripton of *cubense*, is generally darker, often obscures or completely lacks the black bands, and may even develop considerable pigment on the hyponotum, so as to approach *V kraussii?* in color pattern, some of the specimens from Matanzas are of this type and it appears to be the only one at Majagua (Cf Fischer, 1871, pl XI, 2–4). A third form, which is conspicuous in lots from San Juan de Letrán and La Vigia, practically restricts the black bands to the anterior ¼ of the dorsum, where they are solid and inky black All of the specimens which retain pigmentation show some trace of a light dorsomedian band

V floridana is oviparous, Gibbons (l.c) has described the nidus of what is very probably this species. In one of the Cuban specimens examined, the uterus is greatly enlarged, although much less so than in the pregnant animal of *V. moreleti* and without great disturbance of the doubly-looped spiral Inside is a string of very large eggs, each with an envelope of gelatinous substance and a thin and transparent, but quite tough, membranous capsule. If the capsule is removed, the gelatinous albumen swells to twice its original size I am unable to detect any signs of embryonic development in my material.

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
Binney (1851)	56	32(18)	11(6)	50+	
No 63528, figs 12-14	51 6	39(20 2)	12(6)	56(29)	23(4 4)
	47 2	36(17 2)	13(6)	55(25 8)	23(4 4)
No 79830, largest	56	41(23)	11(6 4)	54(30 2)	22(4 5)
bahamensis (Dall)	54	47(25 5)	17(9)	57(31)	37(2 7)
	63	42(26 5)	16(10)	52(33)	29(3 4)
sloanei (Smpr)	36	42(15)	17(6)	50	2 mm
sloanei (Hffm)	57?	54(31)	12(7)	53(30)	31(3 2)
137803, largest	65 2	38(24 8)	8(5 5)	45(29 2)	20(5)
137804, largest	52 5	44(23)	15(7 8)	53(28)	17(6)
137807, largest	55 2	52(28 5)	15(8 5)	53(29 5)	18(5 5)
137809, largest	48 5	39(18 8)	14(6 6)	52(25 4)	27(3 7)

The genitalia (Cf Leidy) are similar in most particulars to those of *V moreleti*, only salient differences will be noted

Vagina with much larger accessory bursa Leidy gives the form and structure in the distended condition, such as is commonly found in slightly immature animals, in completely mature individuals, it forms a long tongue-shaped mass which is so flattened against the floor of the haemocoele as to be quite easily overlooked Dart gland· tubules (22 counted, Leidy gives 25) much longer and very voluminous, wrapped all around pharynx in normal position, attaining a length about ¾ that of animal Dart papilla (Plate IV fig 14) larger and more evenly cylindrical Verge (Plate IV, fig 13) larger and more elongate, glans relatively smaller and usually tilted sharply back so that orifice is secondarily almost at end of long axis of entire organ, two much heavier and higher ridges run almost parallel to each other for some distance back on orificial side, but gradually diverge and tend to wind around in a dextral spiral These ridges are very prominent, often winglike, near and proximad to the middle of the verge, where they are as hard as a radular cartilage, but do not connect to form a definite transverse loop. The retracted verge tends to bend sharply at the heaviest part of the ridges, this angle as well as the chalky-white glans are prominently shown in Leidy's figure which was apparently drawn from a more extended example Verge retractor origin about 2 mm in front of and distinctly mesiad to anterior corner of pericardium, sometimes double with right branch arising some distance anteriad to center of heart (Cf Semper) The pedal nerves diverge at about the level of the pericardium, i e , about ¼ the length of animal from anterior end.

Veronicella (Leidyula) kraussii (Férussac)? Plate VI, figures 23-26

?*Va. kraussii* Fér (1823, Hist. II, 96^x, pl VIII, D, 7, 8), Antilles, not (?) Fér (1827, Bull Sci Nat Geol , X, 299) or (*Va*) Deshayes (1851, Hist , III, pl VIII, E-4), St Pierre, Martinique
Va kraussii? Smpr (1885, 314, pls XXV, 7, XXVII, 12), Jamaica
?*Onchidium cubense* Pfr (1840, Arch Nat , VI-I, 250), El Tumbadero, Canimar R., Cuba

?*Vs occidentalis* Arango (1865, 136, 1878, 129), Cuba, Johnson and Fox (1891, 34, in part!), Port Antonio, Jamaica
?*Ve occidentalis* Henderson (1894, 21), Port Antonio
?*Va portoricensis* Smpr (1885, 302, pls XXIV, 6, XXVI, 20), Porto Rico
Ve jamaicensis Ckll (1892 55, 1893, 219), Kingston, Jamaica
Ve dissimilis Ckll (1892, 134), Moneague, Jamaica
Belocaulus sloanei Hffm (1925, 249, in part), Dondon, Haiti?

JAMAICA No 62126 five young specimens from Bog Walk (Fox, 1891), Plate VI, figs 23, 24 No 62130, one young specimen from same locality (Fox, 1891) No 62133 two young animals from Port Antonio (Fox, 1891) No 71910 one very juvenile animal from Moneague (Ckll) No. 137815 one larger and numerous small animals from 1 mile south of Grantstown (near Port Maria) under dead leaves and rubbish by roadside (Henderson?), very immature and but doubtfully recognizable Largest very dark above with very slight median stripe, hyponotum more weakly infuscate than usual Smaller ones darker below, dorsa show two marginal dark zones, bounded mesiad by longitudinal black stripes, and one median reddish-brown zone, about ¼ width of animal and bisected by median light stripe

HAITI No 85633 one immature animal (Simpson), dorsum light brown with still lighter median stripe, and fine but coarsely-meshed, irregular, black reticulation Plate VI, figs 25, 26

Férussac's original figure of *V. kraussii*, which was apparently based on a juvenile bleached animal, without exact locality, is admittedly not identifiable in the strict sense of the word, but the same is true of most of the older species However, the transversely oval anus certainly indicates a member of *Veronicella*, while the dark hyponotum gives the appearance of the present species. Semper, with his usual acumen, clearly recognized this affinity, but every other author has been misled by Férussac's and Deshayes' confusion of the original *kraussii* with specimens later obtained by Rang These Martinique animals are possibly *Vs. occidentalis*, while some of the records of the latter from the Greater Antilles are probably *Ve kraussii!*

As already indicated, Pfeiffer's *cubense* is quite unrecognizable, but its confusion with *occidentalis* may denote this species, although the dimensions (51–63 mm long) indicate much larger animals. As both *portoricensis* and *jamaicensis* (founded on *Va kraussii?* Smpr) were described from juvenile specimens, their identity or specific separation must be determined by future investigation. In the meantime, it seems best to use *V. kraussii* for both of them;

if they are separate species (and Semper's decision should not be lightly set aside!), Férussac's name could be discarded entirely. *V. dissimilis* Ckll. appears to be the description of the adult animal, although he certainly confused *V. floridana*, which also occurs in Jamaica, with it.

The present species must average considerably smaller than either *V. moreleti* or *V. floridana*, as at least one of my specimens (62126) is approaching sexual maturity.

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant. end	foot
kraussii (Fér.), fig. 7	23	38(8.8)	15(3.4)	52(12)	20(5)
kraussii (Smpr.)	22	36(8)	14(3)	55(12)	
portoricensis (Smpr.)	25	36(9)	16(4)	68(16.5)	
dissimilis Ckll., alive	38	39(15)	14(5.5)	59(22.5)	1 mm
preserved	30	40(12)	13(4)	53(16)	1.3-1.5 mm
No. 62126, largest, figs. 23, 24	31	48(14.8)	13(4)	54(16.8)	21(4.7)
No. 137815, largest	37	51(19)	13(4.8)	66(24.6)	25(4)
No. 85633, figs. 25, 26	28.8	40(11.6)	14(4)	56(16.2)	22(4.5)

The genitalia of my only Jamaican specimen that approaches sexual maturity (no. 62126) are very similar to those of *V. floridana*; only salient differences will be noted. Spermatheca (Plate VI, fig. 23) stalk comparatively short, sac long-ovoid, rather weakly demarcated. Vaginal accessory bursa enormously distended so that stretched vas deferens is deeply impressed into its dorsal surface. Dart sac papilla (Plate VI, fig. 24) relatively very large in proportion to verge, tubules of dart gland numerous (32 counted) and actually longer than the animal (despite immaturity!), lower retractor very broad, arising some distance mesiad to origin of verge retractor. Verge (fig. 24) flattened on side towards dart papilla (due to pressure?), glans somewhat similar to that in *V. moreleti* but more elongate, seminal orifice apical, with two fine spiral ridges which are confluent on right side and run completely around verge some distance below glans, retractor short and stout, with origin 3.5 mm. in front of pericardium and connected to that of lower dart retractor by a strip of fibers close to body wall (i.e. approaching bifid condition).

The Haitian specimen (no. 85633) differs in genitalia as well as color pattern. Although the female organs are much more rudimentary, the verge (Plate VI, fig. 25) is relatively longer, its spiral ridges are farther from the distinctly elongate glans and quite widely separated from each other. However, as this verge is considerably more extended than that in the Jamaican specimen, I am rather doubtful as to the systematic value of these differences The dart papilla (Plate VI, fig 26) is large, but appears smaller in comparison with the verge

Vaginulus (Latipes) occidentalis (Guilding) Plate V, figures 18–20

Onchidium occidentale Gldg (1825, Trans Linn Soc , XIV, 323, pl IX, 9–12) St Vincent

Va occidentalis Fischer (1871, 164), Haiti (?), Porto Rico, Guadeloupe, Caracas, Venezuela, C & F (1878, 673, pl XXVIII, 21–26), Guadeloupe, Angas (1883, P Z S , 597), Dominica, Smpr (1885, 313 pls XXV, 1, XXVII, 13, 14), St Thomas

Ve occidentalis Binney and Bland (1874, Ann Lyc Nat Hist N Y , X, 339), Guadeloupe, Henderson (1894, 21), Port Antonio, Jamaica (?), Thiele (1910, Zool Jahrb Suppl XI, 125), Barbados (Bathseba)

?*Vs occidentalis* Johnson and Fox (1891, 34, in part?), Port Antonio, Jamaica

Cylindrocaulus occidentalis Hffm (1925, 144, 234, exc syn , pl V, 45d, 2), Arecibo, Porto Rico

Va krausei "Fér " Desh (1851, pl VIII, E, 4), probably (Cf Fér , 1827, 299) from St Pierre, Martinique (Rang) not (?) *Vs krausei* Fér (1823, 96^{z}, pl VIII, D, 7, 8) from Antilles (Krauss)

Va punctatissima Smpr (1885, 299, pls XXIV, 4, XXVI, 18, 21), Porto Rico, St Thomas (type locality) and Trinidad, form with dorsomedian stripe, Pils (1893, Trans Conn Acad , VIII, 357), Dominica

Ve sp nov vel *punctatissima* subsp , Ckll (1895, 143), Volcán de Chiriqui, Panamá

Ve sp Ckll (1897, Jour Mal , VI, 5), Dominica

?*Ve stolli* Martens (1898, Biol Cent Amer , 351, pl XIX, 13, 14), Retalhuleu, Guatemala (Pacific slope!)

DOMINICA No 57954 one fully mature animal (G E and A H Verrill, 1892), coloration as in *punctatissima.* No 71911: three very small and juvenile specimens from Ckll (Barber), *punctatissima* coloration, *Latipes* spermatheca, verge not unlike that described for *olivaceus* (see below)

PANAMÁ No 117321 one practically mature specimen from Punta de P(?)ña (R E B McKinney, Oct , 1909), *punctatissima* coloration, Plate V, figs 18–20

COSTA RICA No 57963. one small specimen (Gabb), has been dried but shows spots on hyponotum, identification very doubtful No. 105268, one immature animal from near Quebrada Panteón de Liberia (Calvert, Jan , 1910); apical end of verge similar to Semper's fig of *punctatissima, Latipes* spermatheca; scattered black hyponotal spots and light dorsomedian stripe. No 105274 two immature specimens from Bonnefil Farm, Rio Surubre (Calvert, Oct , 1909), *punctatissima* coloration No 105280 one immature animal from Turrucares (Calvert, Aug., 1909); same coloration No 105290 one immature animal from Turrialba, at 2500 ft (Calvert, Oct , 1909), identification mainly based on coloration.

Jamaica? No 62136 one very immature animal from Bog Walk (Fox, 1891), *punctatissima* coloration *Latipes* spermatheca, verge very immature (see *Vs nesiotis*)

The question of *Vs kraussii* Fér has already been discussed, the original name is prior to *occidentalis* Guilding's specimens apparently lack the light dorsomedian stripe that characterizes most specimens of this species (*punctatissima*), but his figure certainly shows the hyponotal spots Crosse and Fischer's anatomical data seem to represent *occidentalis*, although they missed the connection between the spermathecal sac and its stalk and appear to have anthropomorphized the verge Semper's figure for *occidentalis* appears to be a lateral view of a somewhat distorted verge, while his fig. 21 of *punctatissima* is an excellent representation of a frontal view of a somewhat immature organ Hoffmann's figure is rather highly idealized, but I suspect that he also had an immature specimen before him (locality?) Martens gives no anatomical data for his *V stolli*, but his figure agrees closely in pattern and form with juvenile examples of *occidentalis* from Costa Rica, although the ground color is described as reddish brown (living animal!) Cockerell apparently had both the bandless and banded races in his Panaman material, but all of my specimens represent the latter form According to Guilding, this species is oviparous As will be discussed on a later page, I am inclined to suspect that both *Ve olivaceus* Stearns and *Va nesiotis* Srth will prove to be additional synonyms or subspecies

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
Guilding's fig 10	59 3	24(14 5)	9(5 5)		
punctatissima (Smpr)	38	33(12 5)	12(4 5)	50(19)	[20(5)]
occidentalis (Smpr)	53	26(14)	9(4 5)	57(30)	20(5)
occidentalis (Hffm)	65	30(19 5)	11(7)	52(34)	26(3 8)
stolli (Martens)	25	24(6)			
Cockerell (1895)	41 5	29(12)	9(4)	51(21)	2 5 mm.
No 117321, figs. 18–20	40 5	30(12 3)	8(3 4)	54(21 7)	25(4)
No 57954	27 4	46(12 5)	20(5 4)	55(15)	20(5)

The genitalia of the Panaman specimen figured (no 117321) are practically mature Ovisperm duct, posterior end more irregularly and complexly convoluted than in specimen of *olivaceus* figured (Plate V, fig. 15) Prostate quite small in relation to well-developed albumen gland and massive double spiral of uterus Spermoviduct convoluted, considerably thicker than ovisperm duct and abruptly enlarged into a spherical bulb just before origin of oviducal link Vas deferens almost as stout as spermoviduct and practically twice diameter of link, receives prostatic duct and passes to near spermathecal stalk where it gives off long and much convoluted canalis junctor (Plate V, fig 18) Spermatheca sac thin walled, roughly ovoid, with its apical end somewhat tapered, short, thick-walled stalk relatively small In adult specimens, when the spermathecal sac is greatly distended, it completely hides the small stalk so that, at first glance, it appears sessile, this probably explains the difference between Colosi's (1922, An Mus Nac Hist Nat Buenos Aires, XXXI, 502, text-fig 29) representation of the spermatheca of *Vs pterocaulis* (type of *Latipes*) and that of its original author (Srth , 1913, pl XIII-85)

The convoluted second free portion of the vas deferens passes mesiad and then dorsad to the dart sac (Plate V, fig 19) and finally enters at the base of the verge, it is accompanied by a nerve which goes to verge retractor Dart sac papilla elongate-conic, fully as stout as base of verge, gland tubules (14 long and 2 short ventral ones counted) long, basal ⅓ enclosed in strong sheath, retractor long and very slender, arises mesiad to verge retractor but twists outside and above latter to insert at right posterior corner of dart-sheath Verge very long and slender, with noticeably swollen base, apex (Plate V, fig 20) develops recurved glans which hides seminal orifice The distal end of this glans is emarginate, as in *Vs bielenbergii* (Plate V, figs 21, 22), between paired papillae at the corners, while its proximal end is slightly thickened, although not so noticeably so as in the Venezuelan form The main portion of the verge is longitudinally striate, although not so noticeably so as that of *Vs. bielenbergii* Verge retractor long and slender, arises just in front of pericardium and inserts on apex of penis, its last millimeter sheaths a bit of vas deferens The pedal nerves separate just behind the level of the female opening, i e , at about end of anterior ⅔ of animal

Despite its small size (also greatly retracted), the largest Dominican animal (no 57954) is sexually mature The genitalia are very much like those of the Panaman individual; but the cap (glans) has four minute denticulations between the two corner angles at its distal end, the papillae on its back are shorter, the ridge at its base is heavier, and the papillae of the verge body are developed on two longitudinal ridges which extend a short distance proximad from little subcircular processes like those figured for *Vs bielenbergii* (fig 21). The largest example of the other Dominican lot (no 71911) has very immature female organs, but the verge is quite well developed The weak cap is not reflected and its apex is entire, very much like my figure 16 for *Vs olivaceus*

The Jamaican specimen (no 62136) also agrees perfectly with very immature individuals of *Vs occidentalis* in my Costa Rican lots. The verge is undeveloped and somewhat retracted and so is of no assistance in determining the specific identity of the individual (see *Vs. nesiotis*)

Vaginulus (Latipes) olivaceus (Stearns) Plate V, figures 15–17

Ve olivaceus Stearns (1871, Conch Mem VIII, 1), Occidental Department, Nicaragua (McNeil) and Lobitos, near San Francisco, Cal (1866), W G B (1885, 161)

Va olivacea Srth (1913, 296, pl XII, 31–35), Foloon (Polvón?), Occ Dept, Nic

?*Cylindrocaulus olivaceus* Hffm (1925, 232, exc syn, pl V, 45d, 1), Pacuarito, Costa Rica, Panamá

NICARAGUA No 57958 two specimens approaching maturity, from Polvón (spelled Folvon on label), Nicaragua (McNeil); as these were once the property of W G Binney, who stated (l c.) that he had examined the jaw of a specimen from the original lot, they are in all probability cotypes of this species McNeil (1869, 1st Ann Rept Peabody Acad Sci, 84) actually visited this Hacienda Polvón, inland from Corinto (Lat 12° 29′ N, Long 87° W) in August, 1868, so the type locality seems fairly well established. No 57956 one colorless, immature animal from Machuca (J. T. Bransford), verge approaching that of *olivaceus* but immature, *Latipes* spermatheca

The artificial and temporary (?) introduction of this species into California will perhaps never be verified, but it seems probable enough when one remembers that, in 1866 (three years before the opening of the Union Pacific railroad), a large part of the traffic to the Pacific Coast went by the way of Nicaragua. The Veronicellidae appear to thrive especially well under conditions of cultivation, in Mexico, I found *Ve moreleti* much more abundant in sugar-cane fields than in the native forest Also, it is certainly carried by commerce, besides the case of *Ve sloanii* from New England, a Veronicellid was recently found living in the greenhouses of the Botanical Department of the University of Pennsylvania

The two cotypes of this species are badly bleached, but a very slightly lighter middorsal line is still visible on one of them, the hyponotum appears quite unicolor. The anatomical notes are founded on the larger specimen, the other is even less mature sexually.

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
olivaceus (Stearns)	44 2	30(13)	10(4 3)		
olivacea (Simroth)	42	31(13)	9(3 8)	55(23)	20(5)
No 57958, cotypes	39 6	30(11 9)	10(4)	55(21 6)	23(4 3)
	34 7	28(9 8)	10(3 3)	55(19 2)	21(4 7)

Genitalia (Plate V, figs 15–17) quite similar to those of *occidentalis* (animal less mature), only salient differences will be noted Ovisperm duct simply and regularly convoluted Vas deferens second free portion passes ventrad to dart sac. Dart sac papilla stouter and more conical, 15 long and 2 short gland tubules with at least one case of bifurcation Verge almost acrocaul, flattened glans entire and not reflected, but with granulate ridge at base, orifice subterminal, at end of groove between slight longitudinal swellings

These genitalia are certainly very close to those of *Vs occidentalis;* the characters of the verge seemed quite distinctive until after I had found practically the same conditions in a much more immature individual from Dominica (no 71911) As the coloration was probably described from a bleached specimen, its accuracy is very doubtful, slugs with typical *punctatissima* color pattern certainly occur both to the north (Guatemala) and the south (Costa Rica) of Nicaragua Examination of numerous adult individuals in good condition may show valid characters for *Vs olivaceus,* but I feel quite certain that those in my key are not sufficient for its separation Simroth's figure of the verge shows a slight indication of the ridge at the base of the glans, but Hoffmann's appears more highly idealized, their descriptions were certainly founded on even less mature examples

Vaginulus (Latipes) nesiotis Simroth

Va nesiotis Srth (1913, 297, pl XII, 36–42), Kingston, Jamaica
?*Vs occidentalis* J and F (1891, 34, in part ?), Port Antonio, Jamaica
?*Ve occidentalis* Hend (1894, 21), Port Antonio
Cylindrocaulus olivaceus jamaicensis Hffm (1925, 152, 233, in part)

JAMAICA No 62136 one very immature animal from Bog Walk (Fox, 1891), described under *Vs occidentalis*

As this form was described from a single specimen with a broken and distorted verge, its systematic status will largely depend on future material, as indicated above, its absence from most Jamaican lots arouses the suspicion that it was accidentally introduced. Hoffmann confuses this species with both *Ve. kraussii* and *Ve sloanii,* so his record of a second specimen appears rather dubious. My very immature animal certainly has quite typical *punctatissima* coloration; Simroth's individual may have been bleached The anterior position of the female sex opening could easily be caused by differences in retraction (Cf table for *Ve. floridana*)

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
nemolis Srth	35	44(15 5)	11(4)	43(15)	20(5)
jamaicensis (Hffm)	42?	43(18)	9(4)	54(22 5)	25(4)
luciae (Ckll)	67	35(23 4)	16(11)	57(38)	1½ mm

Vaginulus (Latipes?) luciae (Cockerell)

Ve luciae Ckll (1893, Conch II, 220), Fond St Jaques, St Lucia
Cylindrocaulus luciae Hffm (1925, 145)

To all intents and purposes, this is a nude name with an accurate type locality!

Vaginulus (Angustipes) dubius Semper Plate VI, figure 27

Va dubia Smpr (1885, 296, pl XXVI 12), St Thomas
Sarasinula dubia Hffm (1925, 192)

ANTIGUA No 117300 one sexually mature animal (fig 27) and two smaller ones (A P Brown)·

Vs dubius is prior to *Va behnii* Smpr (1885, 310) from Rio de Janeiro, *Va kjellerupii* Smpr (1885, 314) from Bahia and *Va mörchii* Smpr (1885, 319) from "Guadeloup " All of these forms are included by Hoffmann in the synonymy of his "*Sarasinula plebeja,*" a species with New Caledonia (East Indies) as its type locality *Va mörchii* is described in Semper's paper as one of his Old World species, as places with variants of the name "Guadalupe" occur wherever the early Spanish explorers traveled, there is no reason to believe that *mörchii* came from an American locality

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
dubia (Smpr)	40	50(20)	14(5 5)	59(23 5)	50(2)
No 117300, largest	30	52(15 5)	18(5 4)	62(18 5)	47(2 1)

Despite its small size, the specimen dissected is completely mature sexually, in fact, it must have been killed in the act of oviposition as the swollen uterus contained a comparatively small number of eggs (very similar to those of *Ve floridana,* although naturally on a smaller scale) and one of these was at the very base of the uterus, close against the body wall

Spermoviduct (Plate VI, fig 27) elongate and without distinct swelling, although the walls are thinner near the origin of the oviducal link and probably are capable of considerable distension

Albumen gland shrunken Uterus enormously enlarged by contained eggs (mainly omitted in figure) Prostate peculiarly long and slender Vas deferens· portion between entrance of prostatic duct and origin of canalis junctor very long (stretched ?); canalis very short, enters near base of spermathecal sac Spermatheca. stalk rather short and slightly swollen; sac comparatively small, with long axis only slightly oblique to that of stalk, so that entrance of canalis junctor, although at tapered end, is only a short distance from its base (upper end of stalk) Penis and accessories very similar to those in Semper's figure; with 8 short dart-gland tubules, two of which are mere nodules I suspect that Semper stripped back the sheath of the dart papilla beyond the actual base of the latter, as, in my specimen, the papilla is rather elongate conical, with a sharp apical teat, which would correspond to the apical half of that in his figure The lateral ridges of the flattened verge meet at the slightly recurved apex to form a slight papilla which projects over the seminal orifice; the entire organ is about equal in size to the dart papilla The dart retractor joins that of the verge just as shown by Semper. The pedal nerves are in contact to very near the posterior end of the haemocoele

These data certainly place this species in the group *Angustipes* as defined in my key. I doubt very much if this typically South American group of species is very closely allied to the type of *Imerinia* Ckll, a Madagascar slug with a rather peculiar arrangement of spermathecae and canalis junctor (Cf. Simroth, 1913, Voeltzkow, Reis Ostafr III, 166, pl XVII, 118). Neither Hoffmann's description of the spermatheca (1925, 74) nor his drawing of the verge (pl VI, 45i, 2, locality?) of his "*Sarasinula plebeja*" agree with the conditions in *Vs dubius*, although both forms do have a small number of very short dart-gland tubules and apparently are similar in coloration (see key).

Vaginulus (Angustipes) buergeri Simroth Plate VI, figures 28–30
Va bürgeri Srth (1913, 328, pl XIV, 124-126), St Domingo
Cylindrocaulus bürgeri Hffm. (1925, 147, pl V, 45d, 2y)

SANTO DOMINGO. No. 57955 three large and four small animals (W. M Gabb), figs 28–30. Simroth described this species from very immature specimens; Hoffmann gives a much better figure of the verge from the type specimen but apparently ignores Simroth's description of the spermatheca. Comparison of these figures and descriptions with the immature specimens in my lot leave little doubt that this is Simroth's species; peculiarly enough, one of the small animals (dimensions given) distinctly approaches sexual maturity. All of my material is badly bleached, but some examples show a trace of a dorsomedian light stripe and the larger ones have large irregularly scattered black blotches, mainly on the dorsum but occasionally with one or two on the hyponotum. The hyponotum and the sole are always distinctly darkened, and the coloration of the largest of the immature examples distinctly approaches that of *Vs. kraussii*. Probably, Simroth measured the position of the female opening from the sole instead of from the pedal groove, but it is very close to even the latter.

		Animal		Sole	Female Opening Distance from	
		long	wide	wide	ant. end	foot
bürgeri Srth		22	34(7)	9(2)	55(12)	10(10)
No. 57955	immature	25.2	48(12.1)	12(3)	54(13.5)	20(5)
	mature	59.5	36(21.4)	15(9)	58(34.3)	18(5.6)
	figs. 29, 30	60	38(23)	15(9.2)	55(33)	15(6.5)
	fig. 28	66	31(20.5)	12(8)	56(37.2)	17(6)

Spermoviduct, prostate, and vas deferens similar to those of *Vs. olivaceus* (Plate V, fig. 15), but terminal enlargement of first less sharply demarcated. Female genitalia mature but no eggs were observed. Spermatheca (Plate VI, fig. 28) quite similar to that of *Vs. dubius* but with tapered end of sac under and to right of considerably longer stalk, canalis junctor rather long and convoluted, passes around to right side of stalk so as to enter posterior portion of sac near its base. Dart papilla (Plate VI, fig. 29) much smaller than verge, elongate conical with slightly swollen apex and very slight orificial teat, tubules of gland rather stout, quite numerous (26 counted with at least three cases of bifurcation), about ⅓ as long as entire animal and peculiarly dark colored, retractors two in number with origins and insertions much as in *Veronicella* s. s. Verge (Plate VI, figs. 29, 30). roughly lanceolate, with swollen base somewhat triangular in cross section and with apical portion acuminate, two heavy subspiral ridges begin at base and are connected about ⅔ of the way towards the apex by an irregularly transverse fold, beyond which they die out, left side, between spiral ridges, distinctly concave proximad of transverse fold, but flattened so as to form a triangular shield distad to the latter, apex turned away from shield and terminated by a small fleshy cap of glans, which develops three very low and weak papillae on its free end, seminal orifice partially hidden under cap, subterminal and on right side. Verge-retractor very short and stout; broad and slightly bifid origin about 1 mm. in front of pericardium, fibers converge towards insertion on penial apex.

The pedal nerves diverge gradually at about the level of the origin of the verge-retractor, i. e., at about the end of the apical ¼ of the animal.

The spiral ridges on the verge and the rather unique path of the canalis junctor (similar in all three adults) give *Vs bürgeri* a certain general resemblance to section *Leidyula*, but the form of the spermatheca and that of the verge (without chalky-white glans) place it definitely in section *Angustipes* s s (see key) Specifically, this slug must be quite closely related to *Vs pulcher* Colosi, from Ecuador, that author's careful illustration (1922, text-fig 21) of the verge shows distinctly the presence of somewhat similar ridges, but its apical portion is much shorter and stouter, its flattened shield is distinctly transverse and its seminal orifice practically terminal (i e , visible from right side and without definite glans) His fig 22 of the posterior genitalia is rather indefinite, but *Vs pulcher* appears to have a shorter canalis junctor and spermathecal stalk than *Vs bürgeri* Hoffmann's (1925, figs 45h–5) diagrams, if they were actually drawn from the verge of Colosi's species (locality?), must be highly idealized

Vaginulus (Phyllocaulis) gayi Fischer, (vel *decipiens* Semper?)

Va gayi Fischer (1871, 172), Valdivia, Chile, Smpr (1885, 294, pl XXVI, 4), etc
Va decipiens Smpr (1885, 295, pl XXV, 3), Chile, Mexico
Phyllocaulus gayi Hffm (1925 170, 245, pl VI, 45g, 3), Mazathlan (Mazatlan?), Mexico

The following key outlines Semper's principal reasons for his proposal of *decipiens* as a tentatively separate species

A′ Sole with 80 wrinkles to the centimeter, dart glands 24 mm in length, origin of verge retractor at anterior angle of pericardium *Vs gayi*
A″ Sole with 60 wrinkles to the cm , dart glands 10 mm long, verge retractor arises 2 mm. mesiad from lower angle of pericardium *Vs. decipiens*

Semper's Mexican specimen was small, so his identification may be doubtful The introduction of a Chilean species at Mazatlan, one of the principal Pacific ports of the early Spanish colonies, would seem highly probable. As Semper remarks, large series may show intergradation between *gayi* and *decipiens*. Nothing is known of the method of reproduction in Mexican specimens, but a related species, *Vs solea* (Rush, 1893, Naut , VII, 3) from Maldonado, Uruguay, is oviparous

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	sole
gayi Smpr	38	34(13)	16(6)	50	17(6)
	44	32(14)	14(6)	50	17(6)
gayi (Hffm)	66	39(26)	9(6)	32(20)	18(5 6)
decipiens Smpr	42	35(16 5)	15(6 5)	40(17)	[20(5)]
strebeli Smpr	51	30(15 5)	12(6)	50	1 5 mm.

Vaginulus (Phyllocaulis) strebelii Semper

Vs mexicanus Smpr (1885, 293), Mexico
Va strebelii Smpr (1885, pl XXVI, 7)
V strobeli Colosi (1923, 490)
Phyllocaulus strebeli Hffm (1925, 170)

Hoffmann considers that this is also a synonym of *V gayi*, without additional proof, I hesitate to reverse the decision of such an accurate observer as Semper

ADDENDUM

After this paper was finished, five specimens from Guadeloupe, collected July 2, 1914, by a University of Michigan Expedition, have added another species for the Lesser Antilles These individuals are quite close to *Vaginulus* (*Angustipes*) *langsdorfi* (sensu latissimo of Hoffmann, 1925, 245), but differ in the position of the female opening, which is consistently closer to the pedal groove than to the perinotum Their identification and description will be attempted in another paper

EXPLANATION OF PLATES III–VI

Unless otherwise stated all figures are dorsal views made with aid of camera lucida Scales represent lengths of five millimeters, except in case of figs 21, 22 (1 mm) Horizontal lines across vagina and hindgut indicate slit where they enter body wall In figures of opened penes, outline of penial wall is shown diagrammatically by dotted lines

PLATE III —*Veronicella* s s Of three scales (5 mm) in lower right hand corner of plate, uppermost is for fig 3, middle one for fig. 5, and lowermost for figs 1, 2, 4, 6

Fig 1 —*Veronicella sloanii schivelyae* Dissection of posterior genitalia of specimen (98631) in which male organs and spermatheca are practically mature but female organs are still small At full maturity, albumen gland and uterus become greatly enlarged in proportion to other organs, spermathecal sac may be greatly distended without fundamental change in shape Uterus is cut and turned back to expose ducts and spermathecal stalk, only portion of hermaphroditic gland shown

Fig 2 —*V sloanii schivelyae* Opened penis and accessories of same specimen

Fig 3 —*V sloanii schivelyae* Mediodorsal view of pallial complex of another somewhat immature animal (98631), diagrammatic, but accurate as to shape of parts Kidney stippled so as to bring out part underlying pericardium and ureter

Fig 4 —*V sloanii schivelyae* Opened penis and accessories of fully mature animal (85556) Only bases of penial wall and dart glands indicated

Fig 5 —*Veronicella sloanii sloanii* Opened penis and accessories from Jamaican individual (Ckll), maturity slightly more advanced than in fig. 2, note difference in magnification

Fig 6 —*V sloanii sloanii*. Terminations of posterior genitalia and bit of hindgut of same specimen

PLATE IV —*Veronicella*, section *Leidyula* Of four scales (5 mm) in lower right hand corner of plate, uppermost is for figs 9, 11, second for figs. 13, 14, third for figs 7, 8 and bottom one for fig 10

Fig 7 —*Veronicella* (*Leidyula*) *moreleti* Orificial view of retracted verge with its retractor, from sexually mature specimen (133651), same individual is represented in figs 7–11

Fig 8 —*V moreleti* Dart papilla

Fig 9 —*V moreleti* External form of penis and accessories

Fig 10 —*V moreleti* Lateral view of verge alone, to show weaker (right from orificial viewpoint) and transverse ridges Position of orifice indicated by arrow

Fig 11 —*V moreleti* Dissection of posterior genitalia, spermathecal stalk considerably retracted Broken line connects cut and separated ends of oviducal link

Fig 12 —*Veronicella* (*Leidyula*) *floridana* Transverse section through spirally-coiled spermathecal stalk of mature specimen (63528), 4 mm below sac, to show separate lumina of stalk (left) and canalis junctor

Fig 13 —*V floridana* Lateral view of verge alone, from a sexually mature animal (63528) Arrow indicates position of seminal orifice

Fig 14 —*V floridana* Dart papilla, same specimen and scale as fig 13

Plate V —*Vaginulus*, section *Latipes* Scale (5 mm) for figs 15, 17, 18 is lower one at bottom of plate, that of fig 19 is directly above it Scale (1 mm) for figs 21, 22 is below fig 21

Fig 15 —*Vaginulus* (*Latipes*) *olivaceus* Dissection of posterior genitalia of somewhat immature cotype (57958), same arrangement as fig 1, only anterior edge of hermaphroditic gland indicated

Fig 16 —*V olivaceus* Orificial view of apex of verge of same specimen, much enlarged

Fig 17 —*V olivaceus* Opened penis and accessories with verge viewed at right angles to orifice, only base of penial wall indicated

Fig 18 —*Vaginulus* (*Latipes*) *occidentalis* Terminations of posterior genitalia, from practically mature specimen (117321)

Fig 19 —*V occidentalis* Opened penis and accessories, same specimen as fig 18, but different magnification, only base of penial wall indicated

Fig 20 —*V occidentalis* Apex of verge with cap or glans in place, much enlarged

Fig 21 —*Vaginulus* (*Latipes*) *bielenbergii* Lateral view of glans in place on apex of verge, animal from San Esteban, Venezuela (Univ Mich Mus Zool)

Fig 22 —*V bielenbergii* Orificial view of same with straightened glans

Plate VI —*Leidyula* and *Angustipes* Uppermost scale in lower right hand corner of plate for figs 28, 29, 30, second for fig 23, third for fig 27, lowest for figs 24, 25, 26

Fig 23 —*Veronicella* (*Leidyula*) *kraussii ?* Posterior genitalia in place, from somewhat immature animal (62126) Uterus cut and turned back, enormously distended accessory bursa reaches from hermaphroditic gland almost to anterior end of uterus

Fig 24 —*V kraussii ?* Opened penis and accessories of same specimen, but under different magnification. Arrow indicates position of seminal orifice

Fig 25 —*V kraussii ?* Lateral view of verge alone from still more immature animal (85633, Haiti)

Fig 26 —*V kraussii ?* Dart papilla, same specimen and scale as fig 25

Fig 27 —*Vaginulus* (*Angustipes*) *dubius* Posterior genitalia of mature individual (117300) Most of greatly distended uterus omitted, but a single egg is shown to right of prostate

Fig 28 —*Vaginulus* (*Angustipes*) *bürgeri* Terminations of posterior genitalia of mature animal (57055) Spermatheca rolled to left so that sac is partially turned under and entire length of canalis junctor exposed.

Fig 29 —*V bürgeri.* Opened penis and accessories from another specimen (57055) Only base of penial wall indicated

Fig 30 —*V bürgeri* Verge of same specimen, viewed from left side of animal

NOMENCLATURE OF TRACHELOMONAS

BY T CHALKLEY PALMER.

In a paper entitled "Trachelomonas New or Notable Species and Varieties," in Proceedings of the Academy of Natural Sciences of Philadelphia, Vol LXXVII, 1925, pp 15–22, Plate I, issued as a separate on June 1st, 1925, I have described and figured a species under the name *Trachelomonas depressa* sp nov In so doing I have overlooked the reference of B W Skuortzow, in his paper "On New Flagellata from Manchuria," in Journ. North China Branch Royal Asiatic Society, L, 1919, p 101, plate I, where the author describes and figures, on Plate I, figure 36, a form which he calls *Trachelomonas depressa* Swirenko, var *punctata* Skuortzow. The reference is to "Swirenko, D O., Some Information on the Classification and Geography of Euglenaceae Harkov (Kharkov ?) 1915 (In Russian)" Swirenko's paper is not available, and it is for the present impossible to say whether or not that author has described my form, but judging from Skuortzow's account of the variety, one would say not In any case the name *depressa* is preoccupied, and I desire to rename my Brandywine form in the belief that it may prove to be distinct from Swirenko's I now call it *Trachelomonas castrensis* sp nov , in allusion to the fact that the Continental army under Washington was encamped in the immediate vicinity of the type locality.

In my paper above cited I have described also a form under the name *Trachelomonas flava* sp nov B W Skuortzow, in the China Journal of Science and Arts, Vol III, June 1925, Shanghai, in an article entitled "Descriptions of New Species of Trachelomonas Ehrenberg from North Manchuria, China," has described and figured *Trachelomonas curta* n sp in a manner to make one think that he and I had the same form in hand and published it almost or quite simultaneously under two different names. But here my name *Trachelomonas flava* must stand, since *Trachelomonas curta* is preëmpted by daCunha in his paper on Brazilian species, in Memorias do Instituto Oswaldo Cruz, V p 111, 1913

FISHES FROM NATAL, ZULULAND, AND PORTUGUESE EAST AFRICA

BY HENRY W. FOWLER

Several collections, the first installment received by the Academy in 1922, include some very interesting South African fishes. Although few are new, many are quite rare, and indicate extensions in their distribution. Several lots received from Delagoa Bay, in Portuguese East Africa, are probably the first fishes obtained there. Many from Natal are additions to its fauna. Altogether the collections include upwards of 250 species.

African fishes are rare in America. I have, therefore, given notes, and in many cases condensed descriptions, with the idea of variation chiefly in view. These notes, in the case of bony fishes, require a word of explanation. The *depth* refers to the greatest body depth and the number of times it is contained in the body to the base of the caudal fin. The *head* is measured with the same proportions, its width referring to its length, likewise the *snout*, *eye*, *maxillary*, and *interorbital*. When the lower jaw projects in front, the snout is given with the number of times it is included in the head, followed by the statement from snout tip, thus indicating that the lower jaw is not included in this measurement. Likewise, the same dimensions are intended to follow through the description, or until it is stated to be the total head length.

The scales are always counted in the lateral line, when present, otherwise in a median lateral series, and the plus sign indicates an interruption or those on the caudal base. In the case of carangids, it refers to the division of the arch and horizontal section of the lateral line. The abdominal scutes, as in clupeids, are given with the plus sign to indicate those before and those which follow the ventral fins.

To Mr. H. W. Bell Marley, Principal Fisheries Officer of the Natal Fisheries Department, the Academy is indebted for these collections as gifts to its museum. The color notes of many freshly caught specimens were also made by him, and kindly forwarded. They are acknowledged by quotations, freely compiled. I am also indebted to Mr. Romer Robinson, of Durban, Natal, for much valued correspondence. Mr. Marley has also been kind enough to correct some of my determinations of variable species, and greatly assist me with those of rare ones.

HEXANCHIDAE

Notorynchus platycephalus (Tenore)

Eye 3¼ in snout, nostril 5⅓, anterior, close to snout edge, spiracle small, 2⅔ eye-diameters behind eye. Scales with strong median keel, pointed forward and slender lobe behind Pectoral width 1⅔ its length, lower caudal lobe 4¼ in upper "Back dark gray, spotted all over with black, more on sides White lateral line Eye white sprinkled with pale gray" Length 1930 mm

Skinned example, 40 fathoms off Cape coast

SCYLIORHINIDAE

Scyliorhinus regani von Bonde Text figure 1

Depth, to subcaudal origin, 5⅔, abdominal cavity 2¼, head 4⅔, broadly depressed, snout 2½, length 1⅔ width, convexly rounded, eye 6⅓ in head, mouth wide, length 2 in width, short labial fold at hind edge of each lip, teeth [illegible], rather large, tricuspid, median cusp slenderly triangular and greatly longest, nostrils large, flap well over lip or ⅓ of interorbital and cirrus reaches mouth. Scales rather large, rough, tricuspid, median cusp greatly longest and usually with keel First dorsal inserted entirely behind depressed ventral, subequal, second dorsal inserted little nearer anal origin than that of subcaudal, slightly smaller than first dorsal, caudal 4⅓ in total length, no pits, front subcaudal edge 2 in entire fin, pectoral width 1¼ its length, 1⅔ to ventral, which inserted much nearer anal origin than pectoral base, ventral length slightly greater than

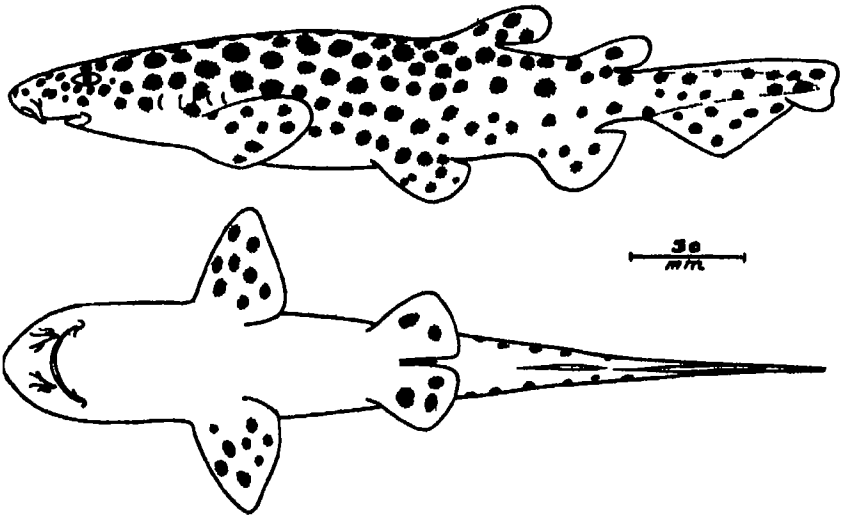

FIG 1 *Scyliorhinus regani* von Bonde

pectoral width Pale brown, spotted all over above with dusky brown, spots also extending on paired fins below Length 225 mm

Natal coast, 20 fathoms

Poroderma pantherinum Smith

Depth, to subcaudal origin, 8 to 11, abdominal cavity 1⅔, head 5⅔ to 6½, width 1¼, broadly depressed, snout 2¼ to 2⅓, length 1½ its width, distance to mouth 3⅗ in head, eye 4½ to 6¼, 1¾ in snout, 2 in interorbital, mouth broad, width 2 in head, gape 2 to 2⅓ its width, lower labial fold behind rictus and along lower jaw ⅔ of mandibular ramus, absent in young, teeth [illegible], tricuspid, median cusp slender and greatly longest, interorbital 2⅔ in head, slightly convex Scales moderate, rough on back and head above, flattened, foliate to weakly tricuspid, with strong median point First dorsal origin over last ⅔ of depressed ventral to hind ventral edge, second dorsal inserted little nearer anal origin than subcaudal origin, slightly smaller than first dorsal, caudal 4⅓ in total length, front subcaudal edge 2¾ in entire fin, anal begins behind depressed first dorsal base, pectoral width 1⅕ to 1⅓ its length, ventral length little more than pectoral width Back and above drab, with many thick set white spots, none larger than pupil and extend over unpaired fins and paired fins above Under surface soiled buff. Length 970 mm

Cape trawl, 140 fathoms

One from Tugela River, in 60 fathoms, 402 mm is marked with spots and rings or enclosures The dark transverse rings often tend to fork a little above and are alternately emphasized or darker

One from Natal coast in 34 fathoms, 250 mm Fawn color on back, thickly spotted all over with rounded, close set, dusky spots, larger and more or less scattered on sides and on fins Under surface whitish

Poroderma africanum (Gmelin)

Depth, to subcaudal origin, 7½, abdominal cavity 2¾, head 4¾, depressed forward, broadly convex behind, snout 2⅗, length ⅗ width, triangular as viewed above and narrowing at tip, eye 5¼ in head, mouth length ½ width, labial fold behind rictus and on lower jaw, latter ⅓ mandibular ramus, teeth [illegible], small, tricuspid, median cusp slender and greatly longest, nasal cirrus short, not reaching lip edge Scales, moderately rough on back and head above, tricuspid, median cusp long and large First dorsal inserted opposite hind depressed ventral edge, little smaller than ventral, second dorsal inserted little nearer subcaudal origin than anal origin, little smaller than first dorsal, caudal 4⅓ in total body length, no pits, front subcaudal edge 2⅓ in fin, anal nearly ⅓ again long as second dorsal, pectoral width 1⅓ its length, 1⅗ to ventral, which inserted nearer anal than pectoral origin and long as pectoral width "White, with 5 stripes of black and faint one each side Eye yellow, with white ring." Length 404 mm.

Bird Islands, in 40 fathoms

Smith's figure of *Scyllium africanum* differs in showing the dark longitudinal lines on the back double

ISURIDAE

Carcharodon carcharias (Linné)

Skin and three teeth from an example 3481 mm long, obtained August 10, 1921 at Bluff Channel, Natal. Harpooned while eating a dead whale.

The following measurements were sent by Mr Marley, girth 1575 mm., first dorsal to second dorsal 783 mm , gill-flap to pectoral point 763 mm , pectoral to ventral 915 mm., ventral to anal 597 mm , caudal width 990 mm , height of anal fin 98 mm , gray-black beneath pectorals

EULAMIIDAE

Scoliodon vagatus Garman

Depth, to caudal notch, 5½, abdominal cavity 2⅔, head 3¾, upper profile straight, depressed forward, convex behind, snout 2⅓ in head, slightly wider than long, eye 7 in head, 3 in snout in profile, mouth width ¾ length, short labial folds on both jaws, upper little longer or ⅔ of eye, reaches ⅔ to hind eye edge in profile, teeth 12 + 1 + 12 above, 11 + 1 + 11 below, bases broad, cusps rather narrow, short, inner or cutting edge well inclined toward mouth angles, all edges entire, upper teeth with slightly wider cusps Scales tridentate, with 3 keels First dorsal origin slightly behind pectoral base, well before inner pectoral end, slightly longer than high, hind edge deeply emarginate and ends behind in sharp, slender point, nearly opposite ventral origin, second dorsal base slightly over half of anal base, hind angle ends in slender point, base ⅔ its distance from caudal, insertion little behind anal origin, caudal 3½ in total length, slender, subcaudal ⅔ of upper lobe, pits well developed, anal third again large as second dorsal, base half space to ventral origin, pectoral ½ in first dorsal base, width 1⅔ length, hind edge concave, ventral small, rounded externally, hind lobe moderate "Back mauve gray First dorsal with black edge and tail deeper at point " Length 355 mm

Delagoa Bay.

Eulamia dussumieri (Müller and Henle)

Depth, to caudal notch, 5¾, abdominal cavity 2⅓; head 4, upper profile very slightly convex, depressed forward, convex behind, snout 2 in head, length ⅔ width, bluntly round, eye 3 in snout in profile, mouth width ⅔ its length; slight notch or pit behind rictus each side represents labial fold, teeth 11 + 1 + 11 above, 12 + 1 + 12 below, oblique; upper with broader basal cusps, serrated, inclined outward above a notch and sometimes strong basal denticle, lower less inclined as smaller and nearly entire cusp with less of notch externally on wide base, sometimes with several small basal denticles. Scales with 5 denticles and 5 keels. Dorsal origin well before inner pectoral end, little higher than long, hind edge deeply emarginate and ends in short sharp point, second dorsal equals anal, origin opposite, similar, base 1⅓ to caudal, caudal 3⅔ in total length, slender, pits moderate, subcaudal 2⅔ in upper lobe, pectoral ¾ in first dorsal base, width half its length, hind edge concave, ventral origin slightly nearer pectoral than subcaudal, rounded externally, hind lobe rather blunt. "Back pale mauve gray Fins pale, second dorsal with upper half black" Most all fins, except second dorsal, with edges posteriorly narrowly whitish Length 375 mm

Delagoa Bay

GALEORHINIDAE

Mustelus mustelus (Linné)

Four young, 140 to 150 mm long, young with cord and yolk sac Cape waters

SQUALIDAE

Squalus fernandinus Molina

Depth 7, head 4⅓, width 1⅓, snout 2⅓ distance to mouth 2, eye 3⅓, 1½ in interorbital, mouth width 2⅔ in head, with deep rictal grooves, interorbital 2⅓, level First dorsal origin over middle of depressed pectoral, opposite middle of inner free pectoral edge, second dorsal origin midway between that of ventral and caudal, pectoral 1⅔, wide as long, ventral 2⅓ Drab gray above, below whitish. Fin edges largely pale, of paired ones whitish Length 235 mm

Natal coast 36 fathoms

Also three young, 200 to 210 mm, same locality in 80 fathoms

ECHINORHINIDAE

Heteroscymnus longus Tanaka

Depth 9⅔ to last vertebra, somewhat compressed, head 3¾ width 2⅓, moderately depressed, abdominal cavity half length without, head, snout 2$\frac{1}{10}$ in head, tip obtuse, width 1¼ length, eye 6¾ in head, 3⅓ in snout, 3½ in interorbital, without membrane, mouth below eye posteriorly, width 3¼ in head, slightly arched forward, with deep straight groove across each angle backward ⅔ to gill-opening, teeth $\frac{18}{16}$, upper slightly raptorial, lower larger, compressed, sectorial, not serrated, median lower tooth present, nostrils large, oblong, at first third in snout, interorbital broadly convex. Spiracle equals pupil, eye diameter behind eye. Scales moderate, triangular points with entire edge, each with median longitudinal groove First dorsal origin little nearer snout tip than caudal base, depressed fin entirely before middle in total; second dorsal origin little nearer first dorsal origin than last caudal vertebra and ends in slender point behind, like first dorsal, caudal broad, subcaudal little shorter, caudal peduncle slightly depressed, depth equals eye, pectoral reaches middle of first dorsal, fin 2¼ in head, ventral inserted midway between front eye edge and last vertebra, vent close behind ventral bases "Brownish black Tips of fins white Eye violet" Length 128 mm

Washed on Durban coast at Point Ocean Beach, April 1, 1923 New to South Africa and only previously found in Japan

SQUATINIDAE

Squatina africana Regan

One from Natal coast 270 mm

PRISTIOPHORIDAE

Pliotrema warreni Regan

Five embryos, 112 to 168 mm long, with yolk-sac, from Natal Each shows saw well developed

PRISTIDAE

Pristis pectinatus Latham

Rostrum width basally 7 in its length, serrae 31–29, closer forward, eye 2⅗ in interorbital, mouth width slightly less than interorbital, teeth $\frac{9}{7}\frac{8}{8}$, in pavement, interorbital slightly convex medianly, spiracles and nostrils oblique. Scales with simple ovoid crowns, larger ending in point behind First dorsal begins opposite first third of ventral base, equals second dorsal, which inserted little nearer subcaudal origin than hind edge of first dorsal, low lateral post-ventral keel, supracaudal lobe slightly more produced than subcaudal, latter with trace of lobe Above olive buff, disk edges, pectoral and ventral edges, caudal lobe and posterior body keels white, like under body surface

One 734 mm long, Durban beach

RHINOBATIDAE

Rhinobatus rasus Garman

Rhinobatus rasus Garman, Mem Mus Comp Zool, 36, 1913, p 270, Pl 17a, figs 1–2 Akkra, Ashantee

Rhinobatus holcorhynchus Norman, Ann Mag Nat Hist, (9) IX, 1922, p 318 Natal

Rhinobatus natalensis Fowler, Ann Natal Mus, 5, pt 2, 1925, p 195, fig. 1 Natal

Disk width 1⅓ in its length, head 4⅓ in total length, snout to eye 5⅓, disk width 3, snout tip to mouth front 5, eye 5⅓ in head, 2 in interorbital; mouth width 3⅞ in head, nearly straight, interorbital 3⅓, crown depressed, level, edges but slightly raised, nostril 5¼, antero-internasal space 2⅗, front nasal lobe feeble, extends half way in nostril length, hind valve ⅔ in nostril length, first dorsal length 2⅓ in head, second dorsal length 2⅞; caudal length 2. Spiracle ⅔ of eye, with prominent outer fold, inner small Slightly darker cloudings of brown down middle of back Length 394 mm

Type of *Rhinobatus natalensis* from off Natal Bluff, in 100 fathoms

RAJIDAE

Raja ocellifera Regan

Depth 2¼ in snout, head to first gill slit 2 in length to vent, disk length 1¼ its width, front angle obtuse and snout tip produced in short point, front edges slightly undulate, tail to base little longer than disk length, 1⅓ in disk width, snout 1⅓ in head to spiracles, eye 2¾ in snout, 1⅖ in interorbital, mouth width 1¾ in snout measured to mouth, cartilaginous interorbital 2⅔ in snout Before each eye 2 strong divergent spines and 1 close behind, strong median vertebral spine, 1¼ in eye, down back of tail row of 10 spines to first dorsal, first opposite middle of ventral, also spine between dorsals Above chocolate, with variable scattered neutral dusky spots, few or obsolete toward disk margins and none ocellated On caudal 5 transverse neutral dusky bands or blotches Below whitish, margin of disk grayish Length 183 mm

Natal Also two egg cases, 80 mm

TORPEDINIDAE

Torpedo panthera (Olfers)

Disk subcircular, length 1⅛ width, snout short, greater than interorbital, nearly straight across front profile as seen from above, eye less than spiracle, 2 in level interorbital, mouth small, width slightly over half its distance from front profile, longitudinal fold each side, teeth in 18 rows, small, bases wide, internasal equals mouth width Spiracle eye-diameter behind eye, with 8 or 9 fleshy marginal tentacles behind Skin smooth Dorsals small, inner angles obtuse, origin of first above ventral end, base end slightly behind ventral base, origin of second slightly behind depressed ventral ends, tail 3⅓ in total, small, weak, low fold each side, hind caudal edge convex Nearly burnt umber above, everywhere with small irregular light or pale broken vermiculating lines, some circles, others dots, hooks, bars or blotches and smaller more numerous and crowded along disk edges, especially forward Below whitish, disk edges, ventrals and tail below mottled with dull umber and whitish Length 210 mm

Tugela River mouth, 60 fathoms

Narcine garmani (Regan)

Heteronarce garmani Regan, Ann Mag Nat Hist, (9) 7, 1921, p 414 Natal

Narcine natalensis Fowler, Ann Natal. Mus, 5, pt. 2, 1925, p 198, fig 2 East London

Disk subcircular, wide as long, head 5⅓ in total length, snout to eye 8½; disk width $1\frac{3}{10}$, snout tip to mouth front 8; eye 5 in snout, 3 in interorbital, mouth small, nearly straight, width 3 in snout, interorbital 1⅙, depressed, orbital edges elevated so eyes protrude, front narial valves short, within small flap covering mouth, hind edge of which irregular, first dorsal length 1⅒ in snout, second dorsal length 1, caudal 1⅓ in head, outer ventral edges convex Uniform brown above, edges not narrowly whitish, under surface of body creamy white. Length 260 mm.

Type of *Narcine natalensis* from East London, in 40 fathoms

MYLIOBATIDAE

Aetobatus narinari (Euphrasen)

Two from Durban Bay, 185 and 190 mm wide Each with 8 pale transverse horizontal dusky lines

GONORHYNCHIDAE

Gonorhynchus gonorhynchus (Linné)

Depth 11, head 4⅓, snout 2⅓ in head, eye 4⅓, maxillary 4, not from snout tip, interorbital 4, barbel ¾ of eye Scales 142 to caudal base, above 15, below 13, predorsal 104 D III, 9, inserted slightly behind ventral origin, fin but little larger, A III, 7, inserted midway between ventral origin and caudal base, caudal emarginate, pectoral 1⅔ in head, ventral 2 Pale broccoli brown, nearly whitish below Iris silvery white Dorsal with blackish terminal blotch Anal with blackish blotch on last half Each caudal lobe with white tips and medially dusky Pectoral whitish Ventral largely whitish, with median dusky blotch. Length 100 mm

Natal coast, in 600 fathoms.

CLUPEIDAE

Sardinella melanura (Cuvier)

Depth 3⅞, head 3⅘, width 2¼, snout 3⅗, from snout tip, eye 3¼, broad lid covers last ⅔, maxillary to front pupil edge, length 2¼, expansion 1⅗ in eye, row of moderate conic lower teeth, none above, interorbital 4⅓ in head, level, most of head except jaws, finely striate or venulose Rakers 16 + 35, lanceolate. Scales 43, transversely 10, predorsal 11, each with 5 or 6 transverse vertical striae and fine circuli vertically parallel, humeral venules large, scutes 18 + 12 D. III, 14, first branched ray 1⅗ in total head length, A II, 15, first branched ray 4⅗, caudal 1, forked, caudal peduncle depth 3⅓, pectoral 1⅔, ventral 2⅓. Brownish, silvery white below Fins pale, dorsal end dusted dusky Length 152 mm

Delagoa Bay

Agrees with three examples from Tahiti.

Sardina sagax (Jenyns)

Depth 5⅓, head 3⅖, width 2¾, snout 3⅓ from snout tip; eye 3⅘, 1⅓ in snout, lid broad, maxillary to front pupil edge, length 2⅓, expansion 1⅗ in eye, interorbital 5⅔ in head, nearly level, interorbital cheek and opercle venulose, last with few radiating striae Rakers 32 + 70, lanceolate Scales 50, scutes 21 + 13 D iii, 14, i, third simple ray $1\frac{9}{10}$ in total head length, A ii, 15, i, first branched ray 4½, caudal 1⅓, forked, pectoral $1\frac{9}{10}$, ventral 2¾ Back neutral slaty, sides and below silvery white Row of few small neutral dusky spots along back anteriorly Fins pale, dorsal and caudal lobes dark gray terminally Length 136 mm

Durban beach

Hilsa durbanensis (Regan)

Depth 2⅗ to 2⅘, contour ellipsoid, head 3¼ to 4, width $2\frac{1}{10}$ to 2⅗, snout 3⅗ to 4, from snout tip, eye 3⅓ to 3½, lid covers last ⅗, maxillary to front pupil edge, to eye center in young, length 2¼ to 2⅗, expansion 1¾ to 2 in eye, upper jaw with median notch, less distinct with age; interorbital 4 to 4½ in head, nearly level, preorbital, suborbitals and opercle above venulose Rakers 23 + 38, lanceolate Scales 35 or 36 + 4 or 5, transversely 12, predorsal 14 or 15, each with 1 to 4 vertical striae, very fine circuli vertically parallel, scutes 16 to 18 + 13 D iii, 14, i or 15, i, first branched ray 1⅗ to 1⅘ in total head length, A. iii, 17 or 18, first branched ray 3⅗ to 3⅔, caudal peduncle depth $2\frac{1}{10}$ to 2¾, pectoral 1¼ to 1⅗, ventral 2⅕ to 2¼, caudal 3 in combined head and body, equals head in young Back and head above olivaceous, below silvery white Iris silvery Fins pale, dorsal edge above and hind caudal edge dusky Length 95 to 168 mm

Four from Delagoa Bay

Ilisha hoevenii (Bleeker)

Depth 2¾ to $2\frac{9}{10}$, head 3¼ to 3½, width 2⅕ to 2¾, snout 3⅓ to 3⅔, from snout tip, eye 2⅘ to 3⅕, lid narrow, maxillary to eye center, length $1\frac{9}{10}$ to 2, expansion 2 in eye, interorbital 5 to 6⅗, level, preorbital, cheek, opercle, and top of head posteriorly with venulose striae Rakers 12 + 27, lanceolate. Scales 36 to 38, transversely 12, predorsal 16, each with 2 complete and 5 imperfect median transverse striae and very fine circuli vertically parallel, scutes 16 to 20 + 8. D iii, 13, first branched ray 1⅗ in total head length, A ii, 33 to 38, first branched ray 2⅕ to 3, caudal peduncle depth 2⅘ to $2\frac{9}{10}$, pectoral 1⅗ to 1⅔, caudal $2\frac{9}{10}$ to 3⅕ in combined head and body. Back dusted with brown, sides and below silvery white, also iris. Snout end and mandible dusted with dull dusky Dorsal and caudal grayish, other fins white Length 75 to 166 mm

Two from Delagoa Bay and three from Natal

ENGRAULIDAE

Engraulis vitrirostris Gilchrist and Thompson

Depth 3⅓ to 3⅔; head 4 to $4\frac{1}{10}$, width 2½ to 2⅘, snout 5, eye 3⅗ to 4⅓, maxillary reaches little beyond pectoral origin or to first fifth of pectoral, mandible 1¼ to 1⅓, interorbital 3¾ to 3⅘, convexly elevated, head above and humeral region strongly venulose Rakers 15+21, lanceolate Scales 44 to caudal base, each with 11 transverse striae, of which 2 to 6 sometimes complete medianly, scutes 16 + 10 D III, 9, first branched ray 1⅓ to 1½ in head, A III, 35 to 37, origin below bases of last dorsal rays, first branched ray $1\frac{9}{10}$ to 2, caudal peduncle depth 2⅗ to 2⅞, pectoral 1¼, ventral 2¾ to 2⅘, caudal 3½ to 3¾ in combined head and body, forked Back brown, sides and below silvery white Iris white Fins pale, dorsal and caudal grayish Length 163 to 168 mm

Delagoa Bay, two examples

MORMYRIDAE

Gnathonemus macrolepidotus (Peters)

Depth 3¾, head 3⅗, width 2, snout 3⅗, from snout tip, eye 10⅓, teeth ⅓, small, conic, interorbital 2¾, convexly elevated Scales 68 + 5, 13 above, 18 below, 54 predorsal, each with 26 to 30 marginal striae reticulating and 28 circuli D II, 19, first branched ray 2⅓ in total head length, A II, 25, insertion little before dorsal origin, first branched ray 2, caudal 1½, forked, caudal peduncle depth 3⅓, pectoral 1½, ventral 2½. Dull brown, paler below Length 125 mm

Umhlatuzi River, Zululand

MURAENESOCIDAE

Muraenesox cinereus (Forskål)

Depth $14\frac{9}{10}$, head $5\frac{9}{10}$, width 3⅓, snout 3⅞, eye 11, above last fourth in mouth cleft, mouth 2⅓, interorbital 8⅓, convex Upper teeth biserial laterally, inner row curved and separated by edentulous area, mandibular teeth triserial, erect, median largest and median series ends forwards near symphysis with large canine, around which outer series extends as 6 or 7 larger teeth than those in posterior part of series, premaxillary group of 8 canines, vomer with row of 13 compressed, large teeth, each with basal point in front and behind, close each side lateral basal row of small even teeth Dorsal begins slightly before gill opening, half high as depth, caudal 13¼ in head, pectoral 2⅘, combined head and trunk 2⅓ in tail. Drab gray, little paler below Median fins blackish marginally. Pectoral dusky terminally Length 1803 mm.

Tugela River mouth, in 60 fathoms

MURENOPHIDAE (Muraenidae auct)

Evenchelys macrurus (Bleeker)

Depth 3¾ in head, head 4⅓ to vent, width 4⅓ its length, snout 10⅓, conic, eye 17, 1⅗ in snout, mouth 3¼ in head, interorbital 12⅓ Premaxillary teeth 10 in outer series, with few more irregularly and external and 4 median, maxillary 18 to 20, also some small, scattered, inconspicuous, external and row of 9 or 10 inner depressible, mandibular teeth 24 to 26, inner row 6 or 7 Gill opening little greater than eye Dorsal begins little nearer rictus than gill opening, combined head and trunk 2¾ in tail Drab gray to mouse gray above, pale or gray white on under surface of head and belly Vertical fins all dark neutral drab Length 985 mm

Natal coast.

Lycodontis nudivomer (Günther)

Depth, at pharynx, 10, head 7$\frac{2}{10}$, width 2, snout 5, eye 12, opposite middle in mouth cleft, mouth cleft 2, teeth entire, uniserial, $\frac{33}{32}$, no anterior fangs or vomerine, front nostril short tube near snout tip, hind nostril small pore above eye before interorbital, interorbital 7½, convex, occiput swelling suddenly behind Dorsal origin midway between hind eye edge and gill opening, latter long as eye Combined head and trunk slightly less than tail Maroon brown, covered with white spots On head and front of dorsal spots smaller and crowded, become much larger and sparse on body posteriorly, some nearly large as eye Mouth angles blackish Length 1025 mm

Illovo River, in 29 fathoms

Far less spotted than Günther's figure of *Muraena nudivomer*, based on an example 863 mm

CHARACIDAE

Alestes lateralis Boulenger

Depth 3⅕, elongately ellipsoid, head 3⅗, width 2¼, snout 4, eye 2¾, maxillary 2¾, reaches hind nostril, expansion 3 in eye, upper teeth $\frac{8}{8}$, lower $\frac{8}{2}$, interorbital 3⅓ in head, convex, suborbitals cover cheek except narrow strip at angle Rakers 7 + 13, lanceolate Scales 28 + 2, 5 above, 2 below, 12 predorsal, each with 6 complete radiating striae and 26 circuli D II, 8, first branched ray 1⅓ in head, A III, 16, first branched ray 2¼, caudal peduncle depth 2⅗, pectoral 1⅓, ventral 1⅗; caudal forked, 3¼ in combined head and body Brown above, silvery white below Dark lateral band from head to caudal base medianly, blackish posteriorly and greatest width below hind dorsal rays not over ⅔ of eye Cranium and opercle sprinkled with dark dots Patch of grayish dusky dots above anal base. Dorsal and caudal grayish, other fins whitish Length 52 mm

Wanetsi River, Portuguese East Africa

Alestes imberi Peters

Depth 3, elongately ovoid, head 3⅓, width 2, snout 3½, eye 4, maxillary 3, reaches hind nostril, upper teeth $\frac{8}{8}$, lower $\frac{8}{2}$; interorbital 2⅗ in head, convexly elevated, suborbitals cover most of cheek Rakers 10 + 20, lanceolate. Scales 25 + 3, 5 above, 2 below, 10 predorsal, each with 6 complete radiating striae and circuli fine basally and coarsely horizontal apically D II, 8, first branched ray 1⅓ in head, A ii, 15, first branched ray 2⅛, caudal 1, forked, caudal peduncle depth 2⅗, pectoral 1⅓; ventral 1⅞ Brownish above, sides and below whitish Each scale on back with narrow dusky edges Blackish humeral blotch little larger than pupil. Black blotch at caudal base and in caudal peduncle larger than eye Vertical fins grayish, paired fins whitish Length 52 to 109 mm

Wanetsi River, two specimens.

CYPRINIDAE

Barbus trimaculatus Peters

Depth 3⅓ to 3¾, head 4, width 1⅔ to $1\frac{7}{10}$, snout 3¼ to 3⅔, eye 3¾ to 3⅘, 1¼ in interorbital, maxillary reaches eye, 3⅗ to 3⅓ in head, barbel 2⅗ and front barbel equals eye, interorbital 2⅗ to 3. Rakers 2 + 9, short Scales 29 or 30 + 2 or 3, 6 above, 3 below, 10 or 11 predorsal, each with 5 basal and 5 apical complete radiating striae, apically 13 feeble auxiliaries and circuli fine. D III, 8, first branched ray 3¾ to 4 in combined head and body, A iii, 5, first branched ray 1⅔ in head, caudal 3⅛ to 3⅗ in combined head and body, caudal peduncle depth 1⅘ to 2 in head, pectoral 1⅛ to 1⅓, ventral 1⅛ to 1⅓ Back brown, white below Along vertebral axis 3 rounded black lateral spots, first above pectoral end, second behind dorsal base and third at median caudal base on lateral line, while first and second spots both above lateral line Fins all pale Length 80 and 100 mm.

Wanetsi River, Portuguese East Africa, and Nongama, Zululand. Former differs slightly in back, dull olivaceous above and also an additional dark blotch behind anal base just above lateral line which varies on left side of body as double blotch

SILURIDAE

Eutropius depressirostris (Peters)

Depth 4⅛ to 4⅘; head 4 to 4¼, width 1⅘ to 1⅗, snout 2⅗ to 2⅘, from snout tip, eye 5 to 5⅘, 1⅓ to 1⅘ in snout in profile, maxillary 3 to 3⅒ in head, ⅘ to eye, nasal barbel 2⅓ in head, outer mental 1⅗ to 1⅘, inner mental 3⅞ to 4⅘, maxillary 2, interorbital 2⅒ to 2⅘, broadly convex Rakers 4, 10, lanceolate. D. I, 6, first branched ray 1⅛ to 1⅞ in total head length, A iii, 49 to 53, first branched ray 2⅛ to 2¾; caudal 1⅛ to 1¼, forked, caudal peduncle depth 2¾ to 3¼, pectoral 1⅓ to 1⅗, ventral 2⅛ to 2¼. Back narrowly olive brown. Brown band from dusky humeral blotch to caudal base and another from pectoral base to base of lower caudal lobe. Dorsal dusky terminally, pale basally. Caudal grayish, each lobe with median dark streak. Anal dusky brown, with median pale or longitudinal whitish line. Pectoral dusky medianly and above, lower edge whitish all around Ventral whitish Maxillary and nasal barbels brownish, mentals whitish Length 130 and 163 mm

Two from Wanetsi River

CLARIIDAE

Clarias gariepinus (Burchell)

Depth 6⅗ to 7, head 4⅕ to 4⅗, width 1⅗, snout 2¾ to 3¼, eye 9⅓ to 11, 2¾ to 3¾ in snout in profile, villose teeth in moderately wide bands in jaws and vomer with granular band wide as upper jaw band, maxillary barbel 1 in head, nasal 2⅕, outer mental 1¼ to 1⅓, inner mental 1⅕ to 2, interorbital 2 to $2\frac{1}{11}$, slightly convex Rakers 8 + 32, lanceolate Head rugose above, covered with thin skin, opercle with 5 radiating striae, occipital bony bridge to dorsal very incomplete D 68 to 70, origin behind first third in combined head and body, fifth branched ray 3¼ to 3⅗ in head, A 51 to 59, fifth branched ray 4¼ to 5, caudal 1⅗ to 1⅘, convex behind, caudal peduncle depth 2⅘ to 4, pectoral 1⅗ to 2⅕, spine with 16 concealed serrae on outer edge, ventral 2⅗ to 3 Neutral tint above, with faint, fine, darker and lighter mottlings and same on vertical fins, all of which darken terminally, but edges narrowly white. Barbels grayish, upper more neutral, mental pink or whitish basally Gray brown streak along lower side of head toward pectoral base Upper lip narrowly edged white, lower narrowly dusky brown. Whitish of abdomen extends on tail along anal base Anal brownish terminally Caudal with pale transverse band. Length 23 to 180 mm

One from Wanetsi River, and Cato Creek, one

SYNODONTIDAE

Trachinocephalus myops (Schneider)

Depth 5¼, head 3⅗, snout 6⅓, eye 7⅘, maxillary 1¾, jaw teeth in 2 or 3 unequal rows, larger on maxillary and depressible, biserial band of smaller teeth on each palatine, joined across vomer, patch of conic depressible teeth on tongue and another behind, interorbital 7¼, deeply concave Rakers as series of fine, irregular, small, close-set denticles Scales 51 + 4, 4 above, 7 below, 17 predorsal, 5 rows on cheek behind eye and 2 rows on opercle above, rest of head naked below D II, 12, I, first branched ray 1⅘ in head; A. 15, I, last branched ray 3⅗, caudal 1⅗, forked, pectoral 2⅗, ventral 1⅕. Pale brown, lighter below, with slightly darker brown or grayish longitudinal stripes Blackish scapular blotch Fins pale brownish Length 210 mm

Delagoa Bay.

Synodus japonicus (Houttuyn)

Depth 6; head 3⅘, snout 4⅕, eye 8¼, 2 in snout, maxillary 1⅗ in head, premaxillary teeth pointed, outer row small, concealed, fixed, and inner row larger and depressible, lower teeth more numerous and biserial, vomer and palatines with long narrow band of teeth, anterior larger and more crowded, 6 rows of rather large teeth on tongue, interorbital 7⅘ Rakers obsolete, minute points Scales 59 + 4, 6 above, 6 below, 21 predorsal, 10 rows behind eye and not extending beyond maxillaries. D III, 10, I, first branched ray 2⅗ in head, A II, 7, I, first branched ray 2⅔, caudal 1⅗, forked, pectoral 2⅗, ventral 1⅕ Dusky olive above, below whitish On back 7 dusky saddle like blotches with alternating paler ones Head blotched with dusky and 2 dusky bands across jaws below Dorsal and caudal grayish, finely banded with dusky, other fins whitish Length 213 mm

Delagoa Bay

Synodus synodus (Linné)

Depth 7¾, head 3¾, width 1⅘, snout 3⅓, eye 7, 2 in snout, 1⅗ in interorbital, maxillary 1⅓ in head, upper jaw teeth uniserial, lower biserial and band of 3 or 4 series on each palatine, interorbital 4¾, bony interorbital 7, concave Scales 58, 4 above, 6 below, 19 predorsal, 5 rows on cheek, each with 3 basal striae. D II, 10, I, first branched ray 2¼ in head, A. I, 9, I, first branched ray 3⅗, caudal 1⅘, forked, pectoral 2⅔, ventral 1⅕ Back drab gray, below whitish, former finely dotted and mottled with darker Scapular region and upper part of opercular flap with some neutral dusky blotches Ten leaden median lateral blotches Fins pale Length 275 mm

Natal

This is evidently *Esox synodus* Linné, described from America, and later as *Saurus atlanticus* Johnson from St Helena

POECILIIDAE

Aplocheilus johnstoni Günther

Depth 3⅗ to 4, head 3⅘ to 3⅗, width 1¾ to 1⅘, snout 3⅓ to 3¾ from snout tip, eye 2¾, 1⅕ to 1⅞ in interorbital, maxillary 2⅕ to 2⅓ in head, outer enlarged row of teeth in each jaw, narrow inner band of fine ones, interorbital 2¼ to 2⅓, flat Rakers 2 + 10, lanceolate Scales 26 + 4, 8 transversely, 18 predorsal, each with 14 to 16 marginal parallel striae D I, 7, inserted little nearer caudal base than pectoral origin, fourth branched ray 1¼ in total head, A I, 10, origin well before dorsal origin, fourth branched ray 1⅕, caudal 1, convex behind, caudal peduncle depth 1¾ to 2, pectoral 1¼, ventral 1⅗ Above scales narrowly edged dusky, below whitish Jaws dusky Obscure brown lateral band from head to caudal base Fins grayish basally, clove brown terminally Length 31 to 43 mm.

Four from Zinagasi Lake, Zululand

BELONIDAE

Strongylura melanotus (Bleeker)

Depth 5⅕ to 5⅓ in head, body subcylindrical, head 3⅕ to 3⅗ in total, width 1⅓ to 1⅗ in postocular; snout 1⅘ to 1⅓ in head, jaws close completely, eye 2⅕ to 3⅓ in postocular, maxillary concealed, reaches little beyond front eye edge; inner row of teeth larger, conic, well spaced, vertically erect, interorbital 1¾ to 2 in head, level, with wide median depression No rakers Scales 315 + 10 in lateral series, 16 above lateral line, 10 below, 200 predorsal to occiput, 18 behind eye to preopercle ridge, circuli 21, complete, slight ridge along side of caudal peduncle D III, 21 or 22, first branched ray 4⅜ to 6¼ in head, last rays equal front lobe of fin, A II, 20 or 21, first branched ray 3⅓ to 4⅞, caudal 2¾ to 3⅓, equally emarginate, caudal peduncle depth 3 in postocular, P I 13, 3⅔ to 4⅓ in head, ventral $3\frac{9}{10}$ to 5⅓ Back greenish brown, sides and below whitish Leaden streak from pectoral axil to middle of caudal base Dorsal and caudal dusky, former blackish posteriorly Pectoral blackish terminally, other fins pale, except gray anal edge Length 442 to 454 *mm.*

Delagoa Bay, two examples

Ablennes hians (Valenciennes)

Depth 11¼ to 13¾, head 3⅛ to 3⅝, width 6⅕ to 7¾, snout 1⅞ to 1⅓, from snout tip, eye 10⅓ to 11, 2½ to 3¼ in postocular, 1⅙ to 1⅞ in interorbital, interorbital 8 to 9½ in head No raker Scales very fine, with 26 to 28 + 15 to 22 parallel vertical striae D III, 22, I or 23, I, first branched ray 3 ? to 6⅓ in total head length, A III, 24, I or 25, I, first branched ray 3 to 5, caudal 2⅛, emarginate, pectoral 2⅓ to 4¾, ventral 3⅝ to 6 Back olive, below silvery white Side with 15 neutral gray vertical bars Slaty streak from pectoral axil to caudal base defines color of side. Median fins and pectoral dusky marginally, ventral whitish Length 458 to 855 mm

One from Natal coast and Durban beach, one

HEMIRAMPHIDAE

Hemiramphus dussumieri Valenciennes

Depth 7½ to 7⅞, from upper jaw tip, body subcylindrical, head 4¾, width 2⅝ to 2⅛, snout 2½ to 2⅝ in rest of head, free upper portion little wider than long, width in snout to eye 1¼ to 1⅞, eye 4⅛ to 4⅝ in head from snout tip, 1¾ in snout, 1¼ in interorbital, mouth cleft ⅞ to eye, lower jaw before snout tip 4⅝ to 5 to caudal base, maxillary ⅞ to eye, nearly vertical, expansion slightly less than pupil, $2\frac{9}{10}$ to 3 in head from upper jaw tip, interorbital 3½, level Rakers 7 + 18, lanceolate. Scales 46 to 50 + 4 or 5 in lateral series, 7 above lateral line, 2 below, 33 or 34 predorsal to occiput, few basal scales at front of dorsal and anal, 3 or 4 basal striae D II, 11, first branched ray 2 to 2¼ in head from snout tip; A II, 11, first branched ray 1⅞ to 2, caudal 1⅛, deeply emarginate, caudal peduncle depth 3⅛ to 4; pectoral 1⅝ to 1⅞, ventral 2⅝ to 2⅛, inserted slightly nearer head than caudal base. Pale brown, scales on back narrowly edged dusky Down back 3 neutral dusky close set parallel lines. Narrow neutral dusky streak from above pectoral axil to caudal base medianly, little expanded behind Beak and snout dusky terminally. Iris white. Fins grayish, front dorsal and anal lobes dusky, ventral pale Length 217 to 218 mm

Delagoa Bay, two examples.

EXOCOETIDAE

Parexocoetus brachypterus (Richardson)

Depth $4\frac{3}{5}$ to 5, head 4 to $4\frac{1}{5}$, width 2 to $2\frac{1}{6}$, snout $3\frac{3}{4}$ to $3\frac{4}{5}$, from snout tip, eye $2\frac{3}{5}$ to 3, maxillary 4, interorbital $2\frac{3}{5}$ to 3 Rakers 8 + 19, lanceolate. Scales 38, with 4 or 5 basal striae D. II, 9, I, first branched ray $3\frac{3}{5}$ in combined head and body, A I, 11, I or 12, I, first branched ray $2\frac{2}{5}$ in total head length, ventral $1\frac{1}{5}$ to $1\frac{1}{4}$, inserted midway between snout tip and caudal base, caudal $3\frac{1}{3}$ in combined head and body, P. I, 12, fin $1\frac{3}{5}$ to $1\frac{9}{10}$, reaches middle of dorsal base Back dark neutral gray, below whitish Dorsal white, large blackish blotch anterior and terminal Lower caudal lobe deep gray medially. Pectoral dusky gray, edge above and below whitish Ventral and anal white Length 128 to 142 mm

Two from Natal

Cypselurus furcatus (Mitchill)

Depth 5, head $4\frac{1}{3}$, width $1\frac{2}{3}$, snout $4\frac{1}{4}$, from snout tip, eye $2\frac{4}{5}$, maxillary $3\frac{1}{3}$, largely concealed, not quite to eye, interorbital $2\frac{4}{5}$, broadly concave Rakers 6 + 16, lanceolate. Scales 55 + 3, 8 above, 2 below, 35 predorsal to occiput, 4 to 6 basal striae and 25 to 27 circuli. D I, 12, inserted at last third between eye center and caudal base, first branched ray little less than total head length, A I, 8, origin opposite fifth branched dorsal ray base, first branched ray $1\frac{1}{3}$ in head, caudal 1, forked, caudal peduncle depth 3, pectoral reaches middle of depressed dorsal, ventral inserted midway between front eye edge and caudal base Back light olivaceous, paler below Across belly 3 dusky bands, first from pectoral bases and third just before ventral bases. Caudal white, with 2 dusky cross bands Dorsal dusky, also most of anal Pectoral white above, blackish below and terminally above 3 blackish cross bands. Ventral blackish, with pale subbasal transverse streak Length 130 mm

Durban beach

Quite likely *Cypsilurus bilobatus* Weber and Beaufort is synonymous The barbel described as present at each side of the mouth corner, as broad and ribbon like, is simply a flap on each side in my example, not much longer than the pupil and black terminally.

MACROURIDAE

Coelorhynchus natalensis Fowler

Coelorhynchus natalensis Fowler Ann. Natal. Mus., 5, pt 2, January 1925, p 198, fig. 3

Bluff, Southeast, Natal, in 35 fathoms

PLEURONECTIDAE

POECILOPSETTA Günther

MARLEYELLA new subgenus

Type *Poecilopsetta bicolorata* von Bonde

Differs from the subgenus *Poecilopsetta* Günther in the larger scales, elongated front dorsal rays and dark pectoral

For Mr. H. W. Bell-Marley, of the Natal Fisheries Department.

Poecilopsetta bicolorata von Bonde

Depth 2, head $3\frac{3}{4}$, width $2\frac{3}{5}$, snout, to lower eye, $5\frac{1}{4}$, lower eye 4, maxillary $2\frac{3}{5}$, to middle of lower eye, expansion $2\frac{1}{2}$ in same, teeth small, even, irregularly biserial in jaws and none on palate Rakers 7 + 12, lanceolate Scales 65 + 6, arch $2\frac{1}{3}$ in rest of lateral line, 10 scales above, 24 below, 8 or 9 basal striae and apical points 13 or 14, in 3 transverse series. D 56, second ray $1\frac{3}{5}$ in head; A 46, ninth ray 2, caudal $1\frac{1}{3}$, pectoral $1\frac{3}{5}$, ventral $1\frac{1}{3}$. Brown, with 4 broad, imperfect, dusky cross bands Branchiostegal membranes azure blue below. Vertical fins neutral blackish, with paler shadings. Right paired fins deep brown with dusky to neutral black mottlings. Right side pale brown, also fins pale Length 134 mm.

Natal coast, 30 to 35 fathoms. Differs from the genotype in the subgeneric characters given above

Paracitharus macrolepis (Gilchrist)

Depth $2\frac{1}{3}$, head $3\frac{3}{5}$, width $3\frac{1}{3}$, snout, to lower eye $4\frac{3}{5}$, from snout tip, lower eye 5, maxillary $2\frac{1}{3}$, to hind pupil edge, expansion $1\frac{3}{5}$ in eye; interorbital narrow bony keel. Rakers 6 + 10, lanceolate Scales (pockets) 42 + 3, arch $2\frac{3}{5}$ in rest of lateral line, 10 scales above, 11 below, 4 rows on cheek D 62 ?, height $2\frac{3}{5}$ in head; A. 47, height of 46th ray $2\frac{1}{3}$, caudal $1\frac{3}{5}$, convex behind, pectoral $2\frac{1}{4}$; right ventral $2\frac{1}{2}$ Gray brown on left side. Dorsal and anal pale, with 8 large, well-spaced, dusky blotches on each, also blackish blotch at axil of each last 3 or 4 rays Caudal pale, with some obscure dusky spots Left pectoral and ventral with dusky tints, right pale or whitish like right side Length 210 mm

Natal coast, 35 fathoms

Pseudorhombus natalensis Gilchrist

Depth $1\frac{9}{10}$ to 2, head $3\frac{1}{2}$ to $3\frac{3}{5}$, width $3\frac{3}{5}$ to 4, snout $4\frac{1}{3}$ to $4\frac{3}{4}$ to lower eye, lower eye $3\frac{1}{3}$ to $3\frac{1}{2}$, maxillary $2\frac{1}{3}$ to $2\frac{3}{5}$, to $\frac{1}{3}$ or $\frac{1}{2}$ of eye, expansion 2 to $2\frac{1}{2}$ in lower eye. Rakers 5 + 12, lanceolate Scales 56 + 2, arch $2\frac{1}{4}$ in lateral line, 12 scales above, 18 below, 10 across cheek to preopercle edge, 15 or 16 basal striae and 30 to 35 apical points, basal rows 2 or 3, accessory branch of lateral line not quite half way to dorsal. D 68 to 71, fourth ray $2\frac{1}{10}$ in head; A. 52 to 55, 30th ray $2\frac{1}{10}$, caudal $1\frac{1}{10}$, pectoral $1\frac{1}{3}$, ventral $3\frac{1}{3}$. Left side dull brown, with dusky rings, all at least less than eye Fins pale Right side uniform whitish Length 129 to 132 mm

Natal coast, 33 to 140 fathoms

Pseudorhombus russellii Gray

Depth 2, head 3⅗, width 4, snout 4⅓, lower eye 5⅛, upper eye 1⅓ in snout, maxillary 2¼ to center of lower eye, expansion 1⅓ in lower eye, bony interorbital 3 Rakers 6 + 11, lanceolate Scales 73 + 5, arch 4⅓ in rest of lateral line, 22 scales above, 23 below, row of fine scales on membranes of dorsal and anal between each ray and fin bases also scaly, left scales with 16 or 17 basal striae, apical points 34 to 36 and right scales with 18 to 22 basal striae D 74, begins over upper nostril, height 2¾ in head, A 56, height 2¼, caudal 1⅓, median rays longest, pectoral 1½, ventral 2⅗ Left side umber, scarcely clouded Large dusky black blotch at beginning of straight section of lateral line and another smaller midway in latter Fins pale brown Right side whitish Length 200 mm

Delagoa Bay

Platophrys pantherinus (Rüppell)

Depth 1¾ to 1$\frac{9}{10}$, head 3½ to 3$\frac{9}{10}$, width 3 to 3⅕, snout, to lower eye, 3¼ to 4¼ from snout tip, lower eye 4 to 4¾, maxillary 3 to 3$\frac{1}{10}$, to or little beyond lower eye front, expansion 2⅓ in lower eye, interorbital 4⅗ to 4⅘ in head, concave Rakers 7 to 1 + 8, tubercles Scales 82 to 86, arch 4 to 6 in rest of lateral line, 28 to 37 scales above, 30 to 36 below, 90 to 95 basal striae and 28 to 30 apical points D 88 to 93, height 2¼ to 2⅓ in total head length, A 67 to 72, height 2¼ to 2½, caudal 1⅓ to 1¼, convex behind, pectoral 1 to 1⅗ Left side neutral drab, mottled with darker and small dark rings Along lateral line 2 imperfect blackish blotches, first at arch and second midway in straight section Vertical fins with small dusky spots or specks on rays, also larger scattered blackish spots at intervals Right side whitish Length 157 to 195 mm

Five from Natal, of which two males with fimentous elongated pectorals

SOLEIDAE

Solea fulvomarginata Gilchrist

Depth 2⅓, head 5⅘, width 2⅗, snout to lower eye 3¼, lower eye 1⅓ in interorbital or 3 in snout, upper eye ⅓ eye diameter before lower, mouth cleft 3 in head, crescentic, lips entire, gill-opening edge with fringe of short, fleshy tentacles Rakers 5 + 12, rudimentary points Scales 103 + 8 from accessory dorsal branch, which reaches dorsal base, 37 above, 38 below, 12 or 13 basal striae, apical points 9 or 10, basally 2 rows D 75, height 2⅓ in head, begins little before tubular nostril and adjacent region of head below with many fine, short, fleshy tentacles, also blind side of chin and branchiostegal region, A 63, height 2⅓, caudal 1⅓, free, rounded, P rays 6, both fins equally developed Right side umber, blotched dusky brown, also irregular faint marblings Gill membrane neutral dusky Dorsal and anal like right side, with irregular dusky-brown blotches Caudal with only few small dark blotches Number of small dusky spots or dots along dorsal base and on head above Right pectoral dusky Left side whitish Length 225 mm

Kongue coast, Natal, in 115 fathoms

Solea turbynei Gilchrist

Depth 2¼ to 2½, head 4⅛ to 4¼, width 3 to 3¼, snout, to lower eye, 3⅛ to 3⅙, eye 4¼ to 6, mouth well arched, lower jaw well included, maxillary 2⅓ to 3, not quite to lower eye center, interorbital equals eye, level Rakers 10, short rudiments Scales 90 + 95, 14 or 15 basal striae and 8 or 9 apical points, ctenoid on both sides of body, numerous papillae on left side on snout, extend to left nostril, slight fringe along lower edge of gill opening, more developed on blind side, lips entire D 67 to 69, height 2⅓ in head, A 51 to 53, height 2 to 2⅓, caudal 1⅒ to 1⅓, rounded convexly behind, pectoral 2⅓ to 2⅔, ventral 3 to 5 Right side umber, with scattered irregular small dots of blackish which extend on head, vertical fins and trunk Pectoral largely neutral black, left one white like left side Length 70 to 114 mm

Two from Delagoa Bay

Pardachirus marmoratus (Lacépède)

Depth 2¼, head 4⅔, width 2¾, snout to lower eye 3¾, upper eye 6⅔, advanced, mouth cleft curved, to lower eye center, maxillary 3, lips fleshy, moderate, entire, interorbital 6, depressed, front snout edge and front head edge fringed Rakers obsolete Scales 93 to caudal base, 10 before gill opening, 30 above, 38 below, 35 to 40 basal striae and 5 or 6 incomplete marginals D 70, height 1⅞ in head, A 53, height 1⅔, caudal 1⅓, rounded behind, no pectoral, right ventral 2⅛ "Dark yellow, with dots and reticulations over whole body Eye golden, finely dotted" Length 167 mm

Durban Bay

Cynoglossus attenuatus Gilchrist

Depth 4 to 4¾, head 4¼ to 4⅝, width 4⅝ to 5⅓, snout to upper eye, 2¼ to 2½, upper eye 7 to 10, slightly advanced, mouth cleft 4⅓ to 5, strongly arched, rictus reaches hind lower eye edge, lips moderate Rakers 3 very short rudiments Scales 77 to 80 to caudal base, 9 or 10 above median lateral line to upper, 12 or 13 below, each side 2 lateral lines, also branch along lower head side, right scales with 58 or 59 basal striae, scales all become small along body edges, extend on caudal base and form low basal dorsal and anal sheaths D 108 to 114, height 3 to 3⅓ in head, A 90 to 92, height 3, caudal 2 to 2¾, pointed Pale brown, nearly uniform on left side, right side whitish. Length 180 to 257 mm.

Two from Delagoa Bay.

Cynoglossus durbanensis Regan.

Depth 3$\frac{3}{5}$, head 5$\frac{1}{5}$, width 3$\frac{1}{4}$, snout to lower eye, 2$\frac{3}{5}$, lower eye equals interorbital or 4$\frac{1}{2}$ in snout, upper eye advanced $\frac{3}{5}$ its length to lower, mouth cleft 4$\frac{2}{5}$, rictus nearer snout end than gill opening; lips entire Rakers 10 low rudiments Scales, from accessory lateral line, which $\frac{3}{5}$ to dorsal fin, 109 to caudal base, 21 above to upper lateral line, 27 below, 37 to 43 basal striae and 20 to 22 apical points, basally 3 rows, only on left side 2 lateral lines D. 107, begins nearly opposite snout end, height 4 in head, A 83, height 3$\frac{9}{10}$, caudal 2$\frac{1}{4}$, not free Dull brown, left side with 9 blackish irregular and more or less divided, transverse, cross blotches, interspaces marbled deeper brown Fins blotched dusky. Right side whitish Length 202 mm

Natal coast

Cynoglossus lida Bleeker

Depth 3$\frac{4}{5}$, head 3$\frac{9}{10}$, width 4$\frac{3}{5}$, snout, to lower eye, 2, lower eye 9$\frac{1}{4}$, front edge opposite middle of upper eye, mouth cleft from mandible tip 5$\frac{3}{5}$, rictus much nearer gill opening than snout tip, lips not fringed, interorbital wide as pupil, little concave Scales 90, of which 11 before hind edge of gill opening, 15 above to upper lateral line, 19 below to anal base, 25 to 30 basal striae, 24 to 39 apical points in 3 to 6 transverse series, scales ctenoid on both sides of body, 2 lateral lines on left side only. D 108, A 82, caudal 8 Left side drab gray, finely mottled obscurely with brownish Right side whitish Length 182 mm.

Natal

ZEIDAE

Zeus japonicus Valenciennes

Depth 1$\frac{3}{5}$, head 2$\frac{1}{15}$, width 3, snout 2$\frac{1}{5}$, from snout tip, eye 3$\frac{4}{5}$, 1$\frac{1}{5}$ in snout, maxillary 1$\frac{3}{4}$ in head, reaches eye, expansion 1$\frac{3}{5}$ in eye, interorbital 5$\frac{1}{4}$ in head, slightly convex, opercle with few radiating striae Rakers 4 + 9, spinescent tubercles Scales (tubes) 16 + 32 + 3, circuli 17 to 20. Bony bucklers each with 2 spines, 6 along soft dorsal base, 6 along soft anal base, 2 rows of small spines on preventral edge and 2 rows of 8 on postventral edge D IX, 23, third spine 1$\frac{1}{2}$ in total head length, 14th ray 3$\frac{1}{2}$; A IV, 22, first spine 2$\frac{1}{4}$, 12th ray 3$\frac{1}{5}$, caudal 1$\frac{1}{2}$, convex behind, P 14, length 2$\frac{3}{4}$, ventral reaches tips of depressed anal spines, long as head. Neutral gray, some obscure horizontal lines on trunk and tail Blackish ocellus, size of eye, midway on side Spinous dorsal and anal dusky gray, ventral blackish, other fins pale Length 141 mm

Natal coast, in 35 fathoms.

MONOCENTRIDAE

Monocentris japonicus (Houttuyn)

Depth 1$\frac{3}{5}$, head 1$\frac{4}{5}$, width 1$\frac{4}{5}$, snout 3$\frac{3}{5}$, eye 3$\frac{4}{5}$, equals snout in profile, 1$\frac{1}{5}$ in interorbital, maxillary 2, reaches beyond eye, expansion 1½ in eye, interorbital 2⅛ in head, convex, suborbital width 1⅗ in eye, opercle rugose striate. Rakers 7 + 12, lanceolate Bony bucklers 16, transverse 7, predorsal 5 D VI—11, I, second spine $1\frac{9}{10}$ in head, fourth ray 3; A. I, 9, I, third branched ray $2\frac{9}{10}$, caudal $1\frac{9}{10}$, deeply forked, caudal peduncle depth 4, pectoral 1⅗, ventral 1⅗. Fins and bucklers pale brown, skin between bucklers on trunk and between ridges on head, dusky neutral Length 130 mm

Natal Bluff, 18 miles southeast

HOLOCENTRIDAE

Holocentrus diadema Lacépède

One, 95 mm. long Natal

Myripristis murdjan (Forskål)

One, 183 mm long. Natal

PEGASIDAE

Pegasus draconis Linné

Depth 5, head 2¾, width 1⅓, snout 2, spatulate, each lateral edge minutely denticulate and 2 close set median ridges, eye 4⅓, interorbital 2⅓, concave Trunk above of 3 rings, first with pair of deep median concavities and each of others with single square concavity, tail with 7 rings behind vent D 5, first ray 1½ in head, A 5, first ray 2, P 11, length 2⅓ in combined head and body, ventral 2⅓, caudal 1⅓ in head, vent nearly midway between hind eye edge and caudal base Brown, reticulated with darker Snout and last half of tail blackish Head and trunk below whitish Iris silvery. Fins pale, with some dusky dots on pectoral, caudal and dorsal Length 57 mm

Durban beach

FISTULARIIDAE

Fistularia petimba Lacépède

Depth 1⅗ in eye, head 2⅗ to caudal base, width 10 in head, snout 1⅓, from snout tip, eye 11¾, 8⅓ in snout, maxillary long as orbital socket, bony interorbital 3 in eye Skin naked, smooth D. 15, fifth ray 7 in total head length, A. 14, fifth ray 7½, caudal 7¾, well forked, caudal peduncle depressed, least depth half width, pectoral 8⅓; ventral 14⅞ Back deep neutral gray, below paler, with lilac tints. Fins light brown. Caudal filament blackish Length 434 mm. to caudal tip, filament 100 mm longer

Natal coast.

Fistularia villosa Klunzinger

Depth equals orbit, 11⅓ in head, head 2⅗ to caudal base, width 12⅗, snout 1⅓, from snout tip, eye 12⅓, 9½ in snout, maxillary slightly longer than orbital socket, 7⅗ in snout; bony interorbital 2 in eye. Skin rough velvety to touch, median vertebral row of narrow keels to dorsal and behind to caudal, similar ventral row from behind ventral to vent and behind anal to caudal D 15, fifth ray 6¾ in total head length, A 14, fifth ray 6½, caudal 7⅛, well forked, caudal peduncle depressed, least depth half width, pectoral 8⅝, ventral 18⅓ Back prout's brown, lighter or wood brown below Silvery sheen on opercle Fins pale brown Length 420 mm

Off Natal, in 40 fathoms

Distinguished from the preceding by its rough skin and median row of keels Lives off shore in deeper water.

MACRORHAMPHOSIDAE

Notopogon lilliei Regan

Depth 3¼, head 2⅕, width 4¼, snout 1⅜, from snout tip, bent upward with straight lower profile, eye 5, 3⅓ in snout, mouth very small, maxillary barely ⅓ of pupil, interorbital 5⅓ in head, slightly convex. Rakers 6 + 13, short, slender Scales with 5 parallel horizontal keels, median ends in point and each 4 more similar, small marginal points D VI—12, spinous fin inserted midway between hind eye edge and caudal base, second spine greatly enlarged, elongate and with row of serrae along each hind edge basally, soft dorsal origin little nearer caudal base than spinous dorsal origin, fourth ray 4⅜ in total head length, A 20, third ray 6¼, caudal 3⅓, emarginate, pectoral rays 14, fin $2\frac{9}{10}$ in head, ventral 1⅜ in eye Nearly uniform pale brown Length 110 mm

Natal coast, in 130 fathoms

MUGILIDAE

Mugil longimanus Günther

Depth 3⅝, head 3⅝, width 1¾, snout 4, eye 4, lids broad, cover hind third, diameter 1¾ in interorbital, maxillary 3¾ in head, concealed, reaches eye, upper lip width half of pupil, mandibular angle would form broadly obtuse, no teeth, interorbital 2⅓, broadly convex; lower preorbital edge finely dentate, scaled Rakers 20 + 50, fine, lanceolate Scales 30 + 3, 12 transversely, 20 predorsal, 5 behind depressed spinous dorsal, most of soft vertical fins, finely scaled, axillary pectoral scale 2⅓ in fin, 4 or 5 basal striae, apical fringe of 35 points D. IV—I, I, 7, I, first spine 2 in head, first branched ray 2, origin of soft fin at first ⅜ of anal base, A III, 9, I, first branched ray 2, caudal peduncle depth 2⅜, pectoral $1\frac{1}{10}$, reaches beyond spinous dorsal origin, ventral 1⅜, caudal deeply emarginate, 3⅜ in combined head and body. Back gray brown, rows of scales on back and side above with gray brown line Dorsals, caudal and pectoral grayish, last dusky basally. Lower fins and iris whitish. Length 148 mm

Delagoa Bay.

Mugil seheli Forskål

Depth 3¾ to 3⅞, head 3¾ to 3⅞, width 1⅔, snout 3¾ to 3⅛, eye 4⅛ to 4⅔, lids cover hind half, diameter 1⅔ in interorbital, maxillary 3⅓ to 3¾ in head, not to eye, upper lip width 1⅗ in pupil, mandibular angle would form broadly obtuse, row of minute ciliate teeth, at least above, interorbital 2⅓ to 2¾, broadly convex, lower and hind preorbital edges finely dentate Rakers 20 to 43 + 38 to 44, finely lanceolate Scales 33 to 35 + 5, 11 to 13 transversely, 19 to 29 predorsal, 4 to 6 behind depressed spinous dorsal, soft vertical fins with small scales basally, axilary pectoral scale ⅓ of fin, 7 or 8 basal striae, with 1 to 3 auxiliaries and 44 to 60 imperfect apical points, 4 or 5 transversely D IV—I, 8, i, first spine 1⅘ to $2\frac{1}{10}$ in head, first branched ray 1⅞ to 2⅛, origin of soft fin at first ¼ of anal base, A III, 9, i, first branched ray 1⅘ to 2, caudal peduncle depth 2⅛ to 2¾, pectoral $1\frac{1}{10}$ to 1⅛, to or little beyond spinous dorsal origin, ventral 1⅗ to 1¾, caudal deeply emarginate, 3⅗ to 3¾ in combined head and body "Gray, with 9 or 10 bright silvery arrow-like marks along body, over nose dark Fins transparent, black at base of pectoral and caudal tips" Length 149 to 169 mm

Delagoa Bay, two specimens

Mugil macrolepis Smith

Depth 3⅔, head 4¼, width 1⅔, snout 3⅛, eye 4½, 1⅔ in interorbital, maxillary 5 in head, exposed, not to eye, upper lip width half of pupil, mandibular angle would form broadly obtuse, row of minute ciliate upper teeth, none below, interorbital 2⅓, broadly convex, lower and hind preorbital edges finely dentate Rakers 34 + 47, finely lanceolate Scales 35 + 5, 12 transversely, 25 predorsal, 5 behind depressed spinous dorsal, soft vertical fins largely finely scaled, no axillary pectoral scale, 8 to 11 basal striae and 136 to 148 obsolete apical points D IV—I, 8, i, first spine 1⅔ in head, first ray 1⅔, soft dorsal origin over first ⅓ of anal base, A III, 9, i, first ray 2, depth of caudal peduncle $1\frac{9}{10}$, pectoral 1⅓, ventral 1⅔, caudal deeply emarginate, 3¾ in combined head and body Back and upper side dull gray brown, each scale row with pale gray streak, below whitish Ventrals whitish, other fins gray Length 275 mm

Delagoa Bay

Agrees with *Mugil troscheli* Bleeker, as defined by Weber and Beaufort, showing it to be synonymous

Mugil oligolepis Bleeker

Depth 3⅛, head 3⅗, width 1½, snout 3¾, eye 4⅛, 1¼ in interorbital, maxillary 3⅓ in head, exposed, not to eye, upper lip width 2 in pupil, mandibular angle would form broadly obtuse, row of minute ciliate upper teeth, none below, interorbital 2⅗, broad, slightly convex, lower and hind preorbital edge well dentate Rakers 19 + 40, finely lanceolate Scales 27 + 6, 10 transversely, 19 predorsal, 2 behind depressed spinous dorsal, soft vertical fins finely scaled basally, no axillary pectoral scale, 8 or 9 basal striae, apical points 113 to 132 with 3 series of basal segments. D IV—I, 8, I, first spine $1\frac{2}{3}$ in head, first ray $1\frac{3}{5}$, soft dorsal origin over middle of anal base, A III, 9, I, first ray $1\frac{1}{2}$, caudal 1, deeply emarginate, depth of caudal peduncle 2, pectoral $1\frac{2}{3}$, ventral $1\frac{2}{3}$ Back dull gray brown, below whitish, each row of scales with gray streak Dorsals, caudal, and pectoral grayish, other fins whitish Length 128 mm,

Delagoa Bay.

Likely *Mugil diadema* Gilchrist and Thompson[1] is a synonym, though varies as Depth $4\frac{1}{3}$, head $4\frac{1}{3}$, snout $5\frac{1}{3}$, scales 30, transversely 12, length 313 mm Regan records *Mugil oligolepis* from the Seychelles

SPHYRAENIDAE

Sphyraena obtusata Cuvier

Depth $5\frac{3}{5}$ to $5\frac{3}{4}$, head $2\frac{7}{8}$ to 3, width $2\frac{1}{3}$ to $3\frac{1}{3}$; snout $2\frac{1}{5}$ to $2\frac{1}{4}$, from snout tip, eye 5 to $5\frac{1}{4}$, $2\frac{1}{5}$ to $2\frac{1}{3}$ in snout, maxillary $2\frac{3}{5}$ to $2\frac{4}{5}$ in head, $\frac{4}{5}$ to $\frac{7}{8}$ to eye, expansion $2\frac{1}{4}$ to 3 in eye, teeth erect, vertical, 4 canines forward above, 2 symphyseal, close set, interorbital $5\frac{3}{5}$ to $6\frac{3}{5}$ in head, level, with median depression, preopercle broadly obtuse. Scales 77 to 87 + 8 or 9, 10 above, 10 below, 26 to 30 predorsal to eye, 43 to 46 basal striae D V—I, I, 8, I, first spine $2\frac{1}{3}$ to $2\frac{7}{8}$ in total head length, first branched ray $2\frac{1}{3}$ to $2\frac{4}{5}$, A II, I, 8, I, first branched ray $2\frac{4}{5}$, caudal $1\frac{2}{3}$, pectoral $2\frac{1}{4}$ to $2\frac{1}{3}$, ventral $2\frac{1}{4}$ to $2\frac{1}{3}$, caudal peduncle depth $3\frac{3}{4}$ to $4\frac{1}{10}$. Back brown, below silvery white Dorsal and caudal pale, with terminal dusky gray tint Ventral and anal whitish Length 206 to 217 mm

Delagoa Bay, two specimens.

Sphyraena flavicauda Rüppell

Depth $6\frac{3}{5}$, head $2\frac{3}{5}$, snout $2\frac{1}{4}$, from snout tip, eye $4\frac{1}{4}$, maxillary $2\frac{3}{5}$, not quite to nostril, interorbital $5\frac{1}{4}$ Rakers 2, moderate Scales 76 + 9, 7 above, 8 below, 28 predorsal, 38 to 47 basal striae D V—I, 9, I, second spine $3\frac{3}{5}$ in total head length, second ray $3\frac{1}{10}$, A II, 9, I, second spine 9, second ray $3\frac{1}{4}$, caudal $1\frac{3}{4}$, well forked, pectoral $3\frac{1}{10}$, ventral $3\frac{1}{2}$ Back dark brown, sides, iris and below whitish. Dorsals and caudal gray brown, also upper pectoral rays, ventral and anal whitish Length 197 mm

Delagoa Bay

Sphyraena jello Cuvier

Depth $7\frac{3}{4}$; head $3\frac{1}{2}$, width $4\frac{3}{5}$, snout $2\frac{1}{5}$ from snout tip, eye $6\frac{1}{4}$, $2\frac{3}{4}$ in snout, maxillary $2\frac{1}{4}$ in head, to hind nostril, expansion $1\frac{3}{5}$ in eye, teeth erect, inclined backward, 4 canines in front above and 1 symphyseal below, interorbital $6\frac{3}{4}$ in head, level, with 2 median ridges approximating until midway in snout, preopercle rounded convexly Scales 121 + 9, 13 above, 13 below, 36 predorsal; 14 to 16 basal striae D V—I, I, 8, I, first spine 3½ in total head length, first branched ray 2⅕, A II, I, 7, I, first branched ray 1⅗; caudal 1½, forked, caudal peduncle depth 5, pectoral 2⅗, ventral 3½ Neutral brown above, sides and below whitish Sides and back with obscure dark mottlings Dorsals and caudal dusky, other fins paler Ventral whitish Length 265 mm

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[1] Ann. S Af. Mus, 11, pt 2, 1911, p. 42 Durban Bay

Delagoa Bay.

Sphyraena japonica Schlegel

Depth 7⅗, head 2⅞, width 3, snout 2¼, from snout tip, eye 5⅓, 2⅗ in snout, maxillary to hind nostril, expansion 2 in eye, lower teeth slightly inclined back, and single backward projecting symphyseal canine, interorbital 6, preopercle obtuse, with slight notch behind. Single lanceolate gill raker in angle of gill arch Scales 110 + 5, 12 above, 12 below, 35 predorsal to occiput; 40 to 42 basal striae. D V—I, 8, second spine 3⅗ in total head length, first branched ray 3½, A. I, 8, first branched ray 3⅞, caudal 1⅗, sharply forked, pectoral 2½, ventral 3⅗ Neutral brown on back, sides and below whitish Dorsals and caudal grayish, paired fins and anal white Length 236 mm

Natal.

Sphyraena africana Gilchrist and Thompson is evidently a synonym.

POLYNEMIDAE

Polydactylus sextarius (Bloch)

Depth 2¾ to 3, head 3 to 3⅓, width 2 to 2⅓, snout 4⅓ to 5⅞, eye 3⅓ to 4⅓, lids very extensive, maxillary, from snout tip, 1⅗ to 2⅗, extends little beyond eye center, expansion 2 in eye, interorbital 3⅗ to 3¾ in head, convex, hind preopercle edge serrated. Rakers 12 + 15, lanceolate Scales 40 to 45 + 4 to 8, 5 or 6 above, 9 to 11 below, 18 to 23 predorsal, most fins densely scaly, 3 to 5 basal striae and apical points 50 to 65 with 10 to 14 series of basal segments Small spine at front of lateral line D. VIII—I, 13, I, third spine 1⅗ to 1½ in head, first ray 1½ to 1⅗, A III, 12, I, third spine 3⅓, first ray 1½ to 1⅗, depth of caudal peduncle 2 to 2⅒, pectoral 1⅓, filaments 6, with longest not reaching end of pectoral fin, ventral 1⅗ to 1⅞, caudal 2⅓ to 2½ in combined head and body, deeply forked. Back pale olivaceous, below silvery white Black blotch long as eye at third scale of lateral line, extends over 5 scales. Head pale in front and below Fins dusky to grayish terminally, spinous dorsal and pectoral incline to blackish, pectoral filaments pale. Length 136 to 180 mm

Two from Delagoa Bay, and one from Tugela River in 60 fathoms.

STROMATEIDAE

Stromateus capensis Pappe

Depth 2⅕, head 4⅓, width 1⅗, snout 3, eye 5⅘, 2 in snout, maxillary 4 in head, not to eye, expansion ½ of eye, teeth fine, even, form single compressed edge in jaws, none on palate or tongue, interorbital 2⅗ in head, greatly elevated, convex Rakers 6 + 8, lanceolate Scales 140, close along lateral line, tubes 105, 27 above, 60 below, 32 to 35 concentric striae D v, 38, I, first branched ray 1⅗ in head, A III, 33, I, first branched ray 1½, caudal 2⅘, strongly forked, depth of caudal peduncle 2⅘, pectoral 1⅙, rays II, 22 Brownish, with broad longitudinal slaty gray to bluish bands On back from after dorsal lobe, above lateral line, row of deep blue spots, variable. Vertical fins and pectoral with pale brownish, edges narrowly dusky Iris pale slate Length 338 mm

Kuysna coast, 120 fathoms

NOMEIDAE

Nomeus gronovii (Gmelin)

Depth 2⅗, head 3⅓, width 2¼, snout 4½ from snout tip, eye 3, maxillary 3⅗, to eye, interorbital 3½, level Rakers 7 + 16, lanceolate Scales 47, 4 above, 15 below, 20 ? predorsal, lateral line high along back D X—III, 20, spines little lower than rays, first branched ray 2⅓ in total head length, A III, 15, first branched ray 2⅗, caudal forked, little longer than head, pectoral and ventral each slightly less than head Largely bright silvery white Back and head above dull olivaceous, latter with dusky Five narrow vertical blackish bands Spinous dorsal black Soft dorsal whitish, with 3 blackish blotches Anal whitish, with 3 smaller blackish spots Ventral largely blackish, whitish basally in front Length 73 mm

Natal coast

Psenes indicus Day

Depth 2⅗, head 2¾, width 2⅗, snout 3¾, eye 2¾, maxillary 3, little beyond front eye edge but not quite to pupil, teeth small, fine, even, conic, uniserial in jaws, none on palate or tongue, interorbital 3 in head, level Rakers 10 + 15, lanceolate Scales 44, 5 above, 17 below, 12 predorsal to occiput, 3 or 4 basal striae and 20 to 40 circuli D X, I, 18, fifth spine 2 in head, second ray 2⅗, A III, 14, third spine 5¼, second ray 2¾, caudal 1⅗, forked, pectoral 1⅓, ventral 1⅗ Back bistre, sides isabella color, below silvery white Obscure isabella streak from shoulder to caudal base medially Iris silver white Spinous dorsal slaty black Soft dorsal slate, paler basally Anal brownish basally, edge whitish Caudal grayish, edges paler all around. Pectoral pale brown, paler below. Ventral gray medially, edges whitish Length 65 mm

Richard's Bay, Natal

Possibly *Psenes africanus* Gilchrist and von Bonde may not be different.

CARANGIDAE

Scomberoides sancti-petri (Cuvier)

Depth 3¼ to 4⅕, head 4⅝ to 4¾, width 2⅝ to 2⅞, snout 3⅛ to 3½, from snout tip, eye 4 to 4⅔, 1¼ to 1⅓ in snout, 1⅛ in interorbital, maxillary, 1⅞ to 2 in head, to hind pupil edge, expansion 2⅓ to 3 in eye, interorbital 3⅓ to 3⅝ in head, convexly elevated Rakers 7 + 17, lanceolate Scales elongate, hastate, very small, cycloid, circuli 28 to 50 D I, VII—I, 19, I, third spine 4⅛ in head, first branched ray 1⅞ to 2, A II—I, 18, I, first branched ray 2⅙ to 2½, caudal peduncle depth 4⅞ to 5, pectoral 1⅗, ventral 1⅜ to 1⅘, caudal 4⅛ to 4½ in combined head and body, strongly forked Gray brown above, white below Along lateral line 5 dull neutral dusky blotches, not larger than pupil Iris silvery white Soft dorsal and anal whitish, former with apical blackish blotch Caudal grayish, other fins whitish Length 168 to 215 mm

Delagoa Bay

Scomberoides lysan (Forskål)

Depth 3⅝, head 4¼, width 2⅜, snout 4⅛, from snout tip, eye 4⅛, 1¼ in interorbital, maxillary 1⅔ in head, reaches slightly beyond eye, expansion 3 in eye, interorbital 3 in head, convexly elevated Rakers 2 + 11, lanceolate Scales elongate, somewhat hastate, very small cycloid, circuli 40 D I, IV—I, 18, I, third spine 4⅓ in total head, first branched ray 1⅓, caudal peduncle depth 4⅞; pectoral 1½, ventral 1⅞, caudal 3¾ in combined head and body, forked Gray brown above, silvery white below Row of 6 deep gray blotches along side of back above lateral line Soft dorsal and anal pale buff, former dusky gray marginally Caudal pale, edges dusky gray Paired fins, iris and mandible whitish Length 245 to 267 mm

One from Delagoa Bay, and Natal, one

Decapterus sanctae-helenae (Valenciennes)

Depth 4⅓, head 3½, width 2⅓, snout 3⅛, from snout tip, eye 3½, 1⅛ in snout, lid covers last half, maxillary 2⅝ in head, not to eye, expansion 2 in eye, row of minute teeth in each jaw, little patch above each side anteriorly and triangular patch on vomer, interorbital 3⅞ in head, broadly convex, preopercle flange with radiating venules Rakers 11 + 28, lanceolate Scales 50 + 33, straight section of lateral line 1⅛ in arch, 12 scales above, 35 predorsal to front eye edge, breast scaled, 23 to 25 complete circuli D. VIII—I, 31 + 1, third spine 1⅞ in total head length, first ray 2⅓, A II—I, 27 + 1, first ray 2⅘; caudal 1½, forked, caudal peduncle depth 6⅗, pectoral 1¼, ventral 2⅛ Back olive brown, below whitish. Black spot, less than pupil, on opercle edge Jaw ends brownish Traces of median yellow lateral streak from head to caudal Dorsals and caudal grayish, other fins pale, end of soft dorsal dusted dusky gray Length 145 mm

Delagoa Bay

According to Cunningham *Caranx sanctae-helenae* Valenciennes, *C jacobaeus* and *C muroadsi* Schlegel are synonymous. Schlegel's figure of *C muroadsi* shows maxillary ¾ to eye, small black opercular spot not on humeral arch, dorsal ends brownish and a gilded lateral streak from head to caudal scutes He says it is distinguished from *C sanctae-helenae* by the more elongate form and absence of black points of lateral line, also by anal rays (27). All this is hardly specific The other species of Schlegel, *C. maru-adsi* is probably valid, differing in the larger opercular black blotch, which extends on the humeral arch and apparently by the absence of a gilded lateral streak Its length is given as 250 to 275 mm

Megalaspis cordyla (Linné)

Depth 4¼, head 4⅓, width 1⅘, snout 3⅓, from snout tip, eye 4⅗, 1¼ in snout, 1½ in interorbital, lid broad, maxillary 2½ in head, ⅗ to eye, expansion 1⅔ in eye, villiform bands of teeth in jaws, on vomer and palatines, interorbital 2¾, convex Rakers 9 + 19, lanceolate Scales 25 + 54, arch 4⅓ in straight section of lateral line, 40 to 48 circuli. D VIII-I, 12 + 8, third spine 2⅗ in head, first ray 2⅓, A. II-I, 11 + 6, first ray 2¼, caudal 1⅓, forked, caudal peduncle depth 10; ventral 2, pectoral 1⅘ to caudal base Back olive brown, below whitish Dorsals, caudal, and upper half of pectoral olive gray, otherwise fins whitish. Length 282 to 335 mm

Durban, two examples.

Selar crumenophthalmus (Bloch)

Depth 3¾, head 3⅓, width 2½, snout 3⅖, from snout tip, eye 3$\frac{1}{10}$, lids broad, maxillary 2⅓, reaches ⅓ in eye, expansion 2⅗, bands of fine teeth in jaws and on vomer, interorbital 4½, slightly convex Rakers 11 + 21, lanceolate Scales 57 + 42, arch long as straight section of lateral line, scute depth 2¼ in eye D. VIII—I, 26, third spine 2¼ in total head, first ray 2⅓, A II—I, 22, third spine 4⅗, first ray 2⅗, caudal 1⅓, forked, pectoral 1$\frac{1}{10}$, ventral 2 Back neutral dusky, below whitish Fins pale, dorsals and caudal grayish Length 224 mm.

Natal.

Trachurus semispinosus (Nilsson)

One from Natal, which agrees with material in the U. S National Museum from the Cape of Good Hope Castelnau has named *Trachurus capensis*, said to have 65 to 67 scutes in the lateral line, though so incompletely described it has not since been recognized. My example has scutes 34 + 38.

Caranx dasson *Jordan and Snyder*

Depth 2⅓, head 3, width 2⅓; snout 2¾, from snout tip; eye 4, 1½ in snout, 1⅓ in interorbital, lid narrow, maxillary 2½ in head, reaches eye, expansion 1⅗, interorbital 3⅓, convexly elevated Rakers 8 + 19, lanceolate Scales 59 + 25, straight section 1¾ in arch, scute depth 2⅓ in eye, breast scaled D. I, VIII—I, 23, I, third spine 2⅘ in total head length, first ray 2⅕, A. II—I, 22, I, first ray 2⅞, caudal 1¼, pectoral 1, ventral 2⅙ Back grayish, below whitish No opercular spot. Spinous dorsal dark gray Soft dorsal and anal whitish, each with broad submarginal dusky band, other fins pale Length 143 mm

Natal coast, in 40 fathoms

Previously only known from Hawaii

Caranx ignobilis (Forskål)

Depth 2⅗, head 3¼, width 2⅓, snout 3⅛, from snout tip, eye 3⅞, 1¼ in snout, 1¼ in interorbital, lid over last ¼ of eye, maxillary 2⅘ in head, reaches eye center, expansion 1⅓ in eye, row of strong, conic teeth in each jaw, band of fine villiform ones on vomer, palatines and tongue; interorbital 3¼ in head, convexly elevated, head above, preorbital and preopercle flange venulose Rakers 6 + 15, lanceolate Scales 55 + 28, arch 1⅛ in straight section of lateral line, 20 scales above, 31 below, scute depth 1⅗ in eye, breast naked below, except small median scaly patch close before ventral bases, 20 to 30 complete circuli. D I, VIII—I, 19, I, third spine 2⅗ in total head length, first ray 1¼, A. II—I, 16, I, first ray 1½, caudal 1, forked, caudal peduncle depth 7, pectoral reaches third scute of lateral line or half way to caudal base, ventral 2 in head Back brown, below silvery white. Faint neutral dusky spot on opercle, not larger than pupil Dorsals brown, soft fin paler basally Caudal brown, other fins whitish Length 173 mm

Delagoa Bay

Caranx kalla Cuvier

Depth 3, head 3⅗, width 2⅙, snout 3⅗, from snout tip, eye 3⅗, lid covers half of eye behind, maxillary 2⅓, to pupil, expansion ⅓ in eye, row of small, conic uniform teeth in each jaw, band of villiform ones on vomer, palatines and tongue, interorbital 3⅓, convex, preopercle flange with radiating venules Rakers 12 + 28, lanceolate Scales 36 + 46, arch 2⅓ in straight section of lateral line, 16 scales above, 24 below, scute depth 1⅓ in eye, breast densely scaled, circuli 14 to 23, complete. D I, VIII—I, 23, third spine 2⅘ in total head length, first ray 1⅗, A. II—I, 19, first ray 1²⁄₁₀, caudal peduncle depth 6, caudal widely forked, 3⅒ in combined head and body, pectoral to 12th scute of lateral line or 2⅓ to caudal base, ventral ⅔ to anal. Back gray brown, below silvery white. Iris white Blue black blotch, nearly size of eye, on opercle. Spinous dorsal dusky gray. Soft dorsal grayish, lobe tipped white Paired fins and anal white Length 167 mm

Delagoa Bay.

Caranx sexfasciatus Quoy and Gaimard

Depth 2⅔, head 3¼, width 2⅓, snout 3, from snout tip, eye 4, lid covers last ¼, maxillary 2, to eye center, expansion 1⅓ in eye, row of short conic teeth in each jaw and band of minute ones on vomer, palatines and down center of tongue, interorbital 3⅓, convexly elevated, preopercle edge with radiating venules Rakers 7 + 18, lanceolate Scales 44 + 30, arch 1⅔ in straight section of lateral line, scute depth 2 in eye, breast densely scaled, circuli 13 to 30, complete D VIII—I, 20, I, third spine 2¾ in total head length, first ray $1\frac{9}{10}$, A II—I, 16, I, first ray 1⅞, caudal 1⅓, forked, caudal peduncle depth 6⅓, pectoral 2⅛ to caudal base, reaches sixth scute in lateral line, ventral 2⅛ in head Brown above, below silvery white Small round black spot, barely ⅓ of pupil, on opercle Dorsals and caudal gray, paired fins and anal white Length 182 mm

Delagoa Bay

This is *Caranx hippos* (non Linné) Gilchrist and Thompson,[3] from Natal

Caranx sansun (Forskål)

Depth 2⅜, head 3⅜, snout 3¼, from snout tip, eye 4, lid narrow, maxillary 2¼, to eye center, expansion 1⅓ in eye, interorbital 3¼, elevated convexly, with median ridge to spinous dorsal Rakers 7 + 17, lanceolate Scales 52 + 37, 23 above, 30 below, 32 predorsal to occiput, arch 1⅔ in straight section of lateral line, breast and chest completely scaled, circuli 18 to 30 D I, VIII—I, 20, I, fourth spine 3 in total head length, second ray 2, A II—I, 16, I, second spine 6⅓, first ray $2\frac{1}{10}$, caudal 1 ?, forked, ventral 2⅛, pectoral longer than head, reaches little beyond angle of lateral line Back pale brown, below silvery white Iris buff white Opercle without dark spot Spinous dorsal dusky gray Soft dorsal yellowish basally, upper half of front lobe black and fin pale dusky marginally Anal pale yellowish Caudal bright yellow, upper lobe pale dusky terminally Paired fins pale yellowish "White, with black spots. Fins yellow Eye gray and white" Length 179 mm

Delagoa Bay

Carangoides malobaricus (Schneider)

Depth $2\frac{1}{10}$ to 3⅛, head 3⅛ to 3⅓, width 2⅓, snout 2⅞ to 3, from snout tip, eye 3¼ to 3⅔, 1⅛ in snout, lid marginal, maxillary 2⅓ to 2¾, to eye, expansion ⅔ eye, teeth in villiform bands in jaws, narrowing uniserial behind, and band of villiform teeth on vomer, palatines and tongue, interorbital 3⅞ to 4, convexly elevated; few venules on preopercle flange Rakers 9 to 11 + 23 or 24, lanceolate Scales 60 to 65 + 37 to 40, 23 above, 48 below, arch 1⅔ in straight section of lateral line; scute depth 6 in eye; breast far back as vent naked, circuli 12 to 30 D I, VIII—I, 22, I, third spine 2⅘ in total head length, first ray 1¾, A II—I, 18, I or 19, I, first ray 2, caudal 1⅓, forked, ventral 2⅓, pectoral 2¾ in combined head and body, reaches straight section of lateral line Back brown, below silvery white Upper hind opercle edge neutral dusky space equal to eye. Fins pale brown, lower more whitish Length 155 to 157 mm

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[3] Ann S Af Mus, 6, 1908, p 240

One from Delagoa Bay and Natal, one

Carangoides armatus (Forskål)

Depth 1¾ to 2, head 3¼, width 1⅗ to 2, snout 3⅒ to 3½, from snout tip, eye 3 to 3⅗, 1⅓ in snout, lid covers last ¼, maxillary 2¼ to 2⅗, to pupil, expansion 2 to 2⅓ in eye, band of villiform teeth in jaws and triangular patch on vomer, none on palatines, interorbital 2⅞ to 3⅓, convexly elevated Rakers 12 + 22, lanceolate Scales 70 + 34 or 35, straight section ⅗ of arch of lateral line, scutes moderate, breast naked back far as vent, 48 + 35 to 37 converging circuli, none united on median vertical axis D I, VIII—I, 21, I, fourth spine 2⅓ to 2⅗ in total head length, first ray elongate, filiform, half combined head and body or tip to middle of caudal peduncle, to middle of caudal base in young, A II—I, 18, I, first ray 1⅗, caudal peduncle 5 to 6; ventral 1⅘ to 2, caudal 3 in combined head and body, forked, pectoral to straight section of lateral line, 1⅘ to caudal base Back brown, below silvery white Marginal blackish opercular blotch not quite deep as eye Fins grayish terminally, filaments and spinous dorsal edge dusky Ventral grayish terminally, blackish in young Length 147 to 250 mm

Three from Delagoa Bay

Not previously reported from South Africa

Scyris indica Rüppell

Depth 1⅔, head 2⅗, snout 2, from snout tip, width 2⅔ its length, eye 4 in head, 1⅞ in snout, lid narrowly marginal, maxillary 3 in head, ⅗ to eye, expansion 2⅓ in eye, teeth in villiform bands in jaws and on tongue medianly, palate edentulous, interorbital 5⅓ in head, convexly elevated, with high, trenchant median ridge Rakers 10 + 24, lanceolate Pores 67 + 50 in lateral line, arch 1⅓ in straight section, scutes small and few D. VI—I, 18, I, spines very low, obsolete, first 7 rays filamentous and longest to end of caudal, A. I, 16, I, first 3 rays filamentous, first longest or but little shorter than dorsal, caudal 1⅓ in head, forked, depth of caudal peduncle 8⅔; pectoral falcate, 1⅘ to caudal base, ventral ends in long filaments nearly reaching caudal base. Back above eye brown, below silvery white. Five leaden gray vertical bands on side, nearly twice as wide as interspaces. Opercle deep brown above Fins pale, even whitish on dorsal and anal basally, dusky to blackish terminally Caudal grayish, pectoral pale. Ventral blackish. Length 190 mm

Delagoa Bay.

Blepharis ciliaris (Bloch)

Depth 1¼, head 2⅗, snout 3, from snout tip, width 1⅓ its length, eye 3 in head, maxillary 2⅗, to eye, expansion 2⅞ in eye, bands of villiform teeth in jaws, palate and tongue edentulous, interorbital 3 in head, convexly elevated, median ridge to spinous dorsal Rakers 4 + 15, lanceolate Lateral line without scales, straight section 1⅓ in arch, keel and scutes very slight D VI—II, 19, spines obsolete, first 6 rays elongated filaments longer than body, A II—I, 16, I, soft fin like soft dorsal, only first 4 rays filamentous, caudal 1⅓ in head, forked, ventral 1, pectoral reaches little beyond angle of lateral line "Silvery, with 4 or 5 broad, faint, curved brassy bands" Length 115 mm

Natal

Apolectus niger (Bloch)

Depth 2⅓, head 4, width 1⅞, snout 3⅒, eye 6⅓, 2 in snout, 2¾ in interorbital, maxillary 3⅓ in head, to eye, expansion 1⅞ in eye, teeth fine, uniserial, conic, none on palatine or tongue, interorbital 2, convexly elevated Rakers 7 + 14, lanceolate Scales 110, with dozen along caudal peduncle slightly keeled, 28 scales above, 40 below, single basal stria, circuli 115 to 136 D II, 46, I, third branched ray 1⅓ in head, A II, 37, I, third branched ray 1⅓, caudal peduncle depth 4⅓, caudal 3¾ in combined head and body, forked, pectoral II, 18, length 2⅓, falcate "Body purplish gray, darker on back Caudal fringe, fins, body color Eye coppery, with yellow" Inside thorax dusky Length 500 mm

Natal

LEIOGNATHIDAE

Leiognathus equula (Forskål)

Depth 1¾ to 1⅞, head 3⅛ to 3⅓, width 2 to 2⅒, snout 3, eye 3 to 3⅓, 1⅓ to 1⅛ in snout, maxillary 2⅓ to 2¾ in head, only end exposed, reaches eye, band of small, even, fine, somewhat flexible, short teeth in each jaw, interorbital 3 to 3⅒, convex generally, median depression sloping in wide concavity to occipital process Rakers 5 + 18, lanceolate Pores 56 to 57 to caudal base, chest and breast apparently naked D VIII, 15, I, or 16, I, second spine 1⅝ to 1⅓ in head, A III, 14, I, second spine 1¾, caudal 1, forked, caudal peduncle depth 4⅗ to 4¾, pectoral 1¼ to 1⅓, ventral 2 to 2⅓ Back brown till level with eye, below silvery white Dusky blotch each side of snout Lips pale Dorsals and caudal grayish, hind edge of latter dusky, pale basally, other fins whitish Pectoral axil blackish Length 132 to 147 mm

Two from Delagoa Bay.

Secutor ruconius (Buchanan-Hamilton)

Depth 1¾ to 1⅞, head 3¾, width 2 to 2⅒, snout 3⅒ to 3⅓, from snout tip, eye 2⅕ to 2⅖, maxillary 2⅓ to 2⅖; fine teeth in bands in jaws, interorbital $3\frac{3}{5}$ to 4, convex Rakers 6 + 19, lanceolate Scales very minute, over most of breast, pores 42 to 52 in lateral line which ends opposite middle of soft dorsal D. VIII, 16, second spine $1\frac{3}{5}$ in total head length, A III, 14, second spine $2\frac{1}{3}$ to 3, caudal 1, forked, caudal peduncle depth $4\frac{3}{5}$ to 5, pectoral $1\frac{1}{5}$ to $1\frac{1}{3}$, ventral $2\frac{3}{4}$ Back brown till level with eye above, also blotched irregularly dusky brown Below silvery white Dusky line forward from front eye edge to mandible articulation Dusky streak each side of snout edge above maxillary Opercle with dusky spot above Dorsals and caudal grayish, other fins more whitish, with axillary pectoral base dusky Length 97 to 128 mm

One from Delagoa Bay and two from Natal

Gazza minuta (Bloch)

Depth $2\frac{1}{10}$ to $2\frac{1}{5}$, head $2\frac{7}{8}$ to 3, width $2\frac{1}{10}$ to $2\frac{1}{5}$, snout $3\frac{1}{10}$ to $3\frac{3}{4}$, from snout tip, eye 3, maxillary $1\frac{4}{5}$ to $1\frac{9}{10}$, to front pupil edge, expansion $1\frac{1}{3}$ in pupil, teeth conic, strong, uniserial and 2 anterior in each jaw strong canines, none on palate or tongue, interorbital 3 to $3\frac{1}{5}$ in head, broadly convex Rakers 11 + 13, lanceolate Tubes 30 in lateral line, reach soft dorsal medially D VIII, 16, I, second spine $1\frac{3}{5}$ to $1\frac{7}{8}$ in total head length, A III, 14, I, second spine 2 to $2\frac{1}{5}$, caudal $1\frac{1}{5}$ to $1\frac{1}{4}$, forked, caudal peduncle depth $4\frac{1}{2}$ to $5\frac{1}{5}$, pectoral $1\frac{3}{5}$ to $1\frac{2}{3}$, ventral $1\frac{7}{8}$ to 2 Brown, below little paler Upper lip edge and mandible below dusky Iris white Spinous dorsal and pectoral base dusky Caudal grayish, other fins whitish, with dusky line close along bases of dorsals and anals Length 111 to 128 mm

Delagoa Bay, three specimens

Gazza aequulaeformis Klunzinger appears to differ in the depth $2\frac{3}{4}$

CHEILODIPTERIDAE

Archamia lineolata (Cuvier)

Depth $2\frac{2}{3}$, head $2\frac{3}{4}$, snout $4\frac{2}{5}$, from snout tip, eye $2\frac{5}{8}$, maxillary 2, expansion 3 in eye, reaches $\frac{3}{5}$ in eye, row of fine low teeth in jaws, on each palatine and across vomer, interorbital $3\frac{2}{3}$ in eye, convexly elevated, preopercle ridge slightly uneven, strong spine at angle, preopercle edge denticulate around angle, otherwise entire Rakers 5 + 18, lanceolate Scales 23, 2 above, 7 below, 4 ? predorsal, 2 rows on cheek, 11 to 20 basal striae, apical points 65 or 66 D VI—I, 9, I, second spine $2\frac{3}{4}$ in total head length, first ray $1\frac{2}{3}$, A. II, 14, I, second spine $2\frac{2}{5}$, second ray $2\frac{1}{5}$, caudal $1\frac{1}{4}$, slightly emarginate, caudal peduncle depth 3, pectoral $1\frac{1}{2}$, ventral 2 Pale brown, finely dusted with dusky, little pronounced on back Iris silvery white. Vertical fins pale, with dusky gray dots Blackish ellipsoid blotch at caudal base medially. Paired fins pale "Pinkish, with silvery Caudal pink and other fins lighter, black blotch in tail root" Length 85 mm.

Delagoa Bay.

AMBASSIDAE

Ambassis ambassis (Lacépède)

Depth 2½, head 2⅗, width 2½, snout 4¼, eye 3⅗, maxillary 2½, to pupil, expansion 2⅔ in eye, interorbital 4⅗, little convex, preopercle edge finely serrate, also lower edge of preopercle ridge though its hind edge entire, 5 enlarged serrae at preopercle angle and 3 at ridge angle Rakers 9 + 21, lanceolate Scales 28 + 4, 4 above, 7 below, 16 predorsal, 3 rows on cheek, 3 or 4 basal striae. D. VII, 9, I, second spine 1½ in total head length, first ray 2, A. III, 9, I, third spine 2⅗, first ray 2¼, caudal forked, little less than head, pectoral 1⅓, ventral 1⅔ Cream buff with slight olive tint on back, pinkish buff on head below and belly Narrow leaden line along vertebral axis of tail. Iris and opercle with pale brassy tints Fins pale, second membrane of spinous dorsal tinged dusky. Length 190 mm

One from Natal

Ambassis natalensis Gilchrist and Thompson[3] is doubtless a synonym If *Sciaena safgha* Forskål is the same, as has been contended, this name should be adopted and the species called *Ambassis safgha*

Ambassis urotaenia Bleeker

Depth 2⅗ to 2¾, head 2⅗ to 2⅞, width 2⅗ to 2½, snout 4½ to 4⅗, from snout tip, eye 2¾ to 3, maxillary 2¾ to 2⅞, not quite to pupil, expansion 3½ to 4 in eye, teeth minute, in narrow band in jaws, on vomer and palatines, interorbital 4 in head, slightly convex, lower preorbital edge, lower edge and ridge of preopercle, denticulate hind edges entire Rakers 7 + 21, lanceolate Scales 23, 5 above, 5 below, 11 predorsal, 2 rows on cheek, 7 to 11 weak basal striae D. VI or VIII, I, 8, I to 10, I, second spine 1⅒ to 1⅕ in total head length, first ray 1⅓ to 1⅘, A III, 10, I, third spine 1½ to 1¾, first ray 1½ to 1⅞, caudal peduncle depth 2¼ to 2⅗, pectoral 1⅓ to 1¼, ventral 1⅗, caudal 2½ to 2⅗ in combined head and body, forked Pale brown, scattered dusky dots on scales of back. Row of blackish dots on second membrane of spinous dorsal Length 40 to 52 mm

Delagoa Bay, four examples.

SERRANIDAE

SERRANINAE

Cephalopholis aurantius (Valenciennes)

Depth 2⅔, head 2½, width 2¼, snout 3½, from snout tip; eye 6, 2 in snout, 1¼ in interorbital, maxillary 2 in head, to hind pupil edge, expansion 1⅓ in snout, upper teeth 4 to 6 series and outer enlarged row, lower 4 rows, 3 rows posteriorly; canines ½, concealed broad angled short band of small teeth on vomer and short band on each palatine, interorbital 6 in head, little convex, preopercle edge minutely serrate, upper and lower opercular spines opposite, median closer to lower Rakers 9 + 15, lanceolate. Scales 123 + 10, pores 73 + 4, 17 scales above, 36 below, 38 predorsal to front eye edge, 24 across cheek to preopercle ridge, maxillary minutely scaled above, 4 to 7 basal striae, 13 to 31 apical points with 2 to 10 series of basal elements D IX, 15, I, third spine 3⅓ in total head length, tenth ray 2⅓, A III, 9, I, third spine 3, second ray 2, caudal 1⅗, convexly rounded behind, caudal peduncle depth 2⅗, pectoral 1⅖, ventral 1⅗ Light pink Hind part of body dusted brownish Verticle fin edges narrowly dusky, also caudal membranes terminally. Pectoral and ventral edges more or less dusky Length 333 mm

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[3] Ann S Af Mus., 6, 1908–11, p 148 Inner Harbor, Durban

Delagoa Bay.

Cephalopholis miniatus (Forskål)

Depth 3, head 2½, width 2⅗, snout 3⅗, from snout tip, eye 7, 2 in snout, 1⅕ in interorbital, maxillary 2 in head, to eye center, expansion equals eye, upper teeth 5 to 7 rows and outer enlarged row, lower 4 or 5 rows, 3 rows posteriorly, canines ½, broad angled band of fine vomerine teeth and short band on each palatine, interorbital 6⅕ in head, slightly convex, hind preopercle edge with obsolete fine serrae, lower entire, lower and median opercular spines opposite, closer than advanced upper Rakers 8 + 15, lanceolate Scales 100 + 8, pores 49 + 4, 14 scales above, 32 below, 60 predorsal to nostrils, maxillary minutely scaled, 8 to 10 basal striae, apical points 60 with 3 rows of basal segments D IX, 14, I, fifth spine 4¼ in total head length, fourth ray 3, A III, 9, I, second spine 3, fourth ray 2½, caudal 2, convex behind, caudal peduncle depth 3, pectoral 1½, ventral 2. Pink, with small dusky gray spots, none larger than eye, over head and body except chin, breast and belly, each with dusky edge and some larger on side of abdomen Vertical fins closely spotted darker, edges narrowly dusky Pectoral base with 3 spots, otherwise it and ventral unicolor Row of spots along each lip and maxillary Length 300 mm

Natal coast, in 25 fathoms

Acanthistius sebastoides (Castelnau)

Depth 2¼, head 2⅓, width 2¼, snout 4¼, from snout tip; eye 4¼, maxillary 3, to hind pupil edge, expansion 1⅗ in eye, bands of fine teeth in jaws, biserial along sides of mandible posteriorly, with slightly enlarged outer row above and several each side below, fine teeth on vomer and palatines, interorbital 7⅓ in head 1½ in eye, narrowly concave, hind preopercle edge serrate, 3 spines on lower edge directed forward Rakers 6 + 13, lanceolate Scales 86+9, tubes 52 + 4, 15 scales above, 33 below, 43 predorsal, 19 rows on cheek, very few scales on maxillary expansion above, 8 basal striae and 1 or 2 auxiliaries, 25 to 29 apical points with 3 or 4 shorter basal series, 15 to 17 circuli, apically 55 D XII, 16, I, fifth spine 3⅗ in total head length, third ray 3⅖, A III, 7, I, third spine 4⅓, caudal 2⅓, slightly convex, caudal peduncle depth 3, pectoral 1⅗, ventral 2⅖ "Mauve gray, darker along back and bases of dorsal spines Body covered with spots and streaks of orange red Spots on dorsal larger Eye lid spotted red Face spots smaller Eye silvery and light brown Fins dark brown and black, pectoral yellow" Length 208 mm

North coast Natal, in 8 fathoms

Serranus diacanthus Valenciennes

Depth 3, head 2⅖ to 2⅗, width 2 to 2⅕, snout 4⅘ to 4⅖, from snout tip, eye 4⅘ to 4⅖, maxillary 2⅕, to hind pupil edge, expansion 2 in eye, canines ⅔, teeth small, innermost depressible, biserial along sides of mandible, band of fine teeth on vomer and each palatine, interorbital 6⅔ in head, little convex, hind preopercle edge serrate, 2 largest points below, lower edge entire Rakers 8 + 15, lanceolate Scales 90 + 4, pores 50, 12 scales above, 30 below, 55 predorsal, 30 across cheek to preopercle angle, few small weak scales on maxillary above, 4 or 5 basal striae and 23 to 30 apical points with 5 or 6 basal series D XI, 16, I or 17, I fourth spine 2⅘ to 2¾ in total head length, seventh ray 2¾, A III, 8, I, second spine 3⅕ to 3⅓, fourth ray 2⅙ to 2¼, caudal 1¾, pectoral 1⅗ to 1⅔, ventral 2⅓ "Banded red on pale brown, with white markings and spots on throat and belly" Five broad deep brown transverse bands, reflected on vertical fins, which terminally clouded dusky Jaws with 4 dark blotches and dark streak along maxillary groove Length 128 to 150 mm

Two from Natal

Serranus merra (Bloch)

Depth 2¾ to 2⅞, head 2½ to 2⅝, width 1⅞, snout 4⅕ to 4¼, from snout tip, eye 6 to 6⅗, 1⅓ in snout, maxillary 2⅕ to 2¼ in head, to hind pupil or eye edge, expansion 1¼ to 1⅓ in eye, 3 or 4 upper inner teeth enlarged, depressible, lower in 4 rows anteriorly, 2 posteriorly, band of small teeth on vomer and palatines, interorbital 6 in head, slightly convex, hind preopercle edge denticulate Rakers 5 + 14, lanceolate Scales 117 + 7, pores 47 + 2, 15 scales above, 41 below, 80 predorsal, 5 basal striae, apical points 23 to 30 D XI, 16, I, third spine 3 to 3⅓ in total head length, seventh ray 2½ to 2¾, A III, 8, I, third spine 3⅗ to 3⅘, fourth ray 2⅓ to 2½, caudal 1⅞ to 2, convex behind, caudal peduncle depth 3½, pectoral 1⅞, ventral 2 to 2⅒ "Spotted with shades of brown on a yellow ground, spots smaller on pectoral and caudal" Largest spots smaller than eye, crowded on head above, muzzle, pectoral, caudal, soft dorsal and anal, with narrow pale reticulating line between Spots sparse on breast, belly and under surfaces Length 240 to 275 mm.

Two from Natal

Serranus lanceolatus (Bloch)

Depth 2⅘, head 2⅗, width 2¼, snout 4¾, from snout tip, eye 7¾, 1⅗ in snout, 1¾ in interorbital, maxillary 2⅛ in head, extends little beyond eye, expansion equals eye, mandibular teeth triserial, interorbital 4⅗ in head, little convex, hind preopercle edge finely serrated Rakers 8 + 13, lanceolate Scales 90, tubes 60 + 4, trifid, 19 scales above, 30 below, 80 predorsal, 7 to 9 basal striae D XI, 16, fourth spine 4¾ in total head length, sixth ray 2½, A III, 8, third spine 4⅗, fourth ray 2½, caudal 1¾, convex behind, pectoral 1⅞, ventral 2½ Brown, with 4 broad dusky brown cross bands Maxillary with 3 blackish blotches Fins and lower surfaces yellowish buff generally, former all more or less spotted with blackish Length 290 mm

Umgeni, Natal

Serranus fasciatus (Forskål)

Depth 2⅞ to 3, head 2⅗ to 2½, width 2 to 2⅓, snout 3⅞ to 4⅗, from snout tip, eye 5, 1⅓ to 1⅛ in snout, maxillary 2⅓ to 2⅓ in head, to eye center or hind eye edge, expansion 1¾ in eye, mandibular teeth largely triserial, interorbital 7¾ in head, level Rakers 8 + 17, lanceolate Scales 105 + 6, tubes 46 to 49 + 5, 16 scales above, 33 below, larger predorsal 53 ?, 5 or 6 basal striae, apical points 35 to 42 with 3 to 5 rows of basal segments, maxillary naked D XI, 15, I, or 16, I, third spine 3⅓ to 3⅗ in total head length, eighth ray 2¾ to 3⅓, A III, 8, I or 9, I, second spine 3⅛ to 3⅗, fifth ray 2½ to 2½, caudal 1¾ to 2, convex behind, pectoral 1⅗ to 1⅞, ventral 2⅗ to 2⅗ Pale uniform brown, lighter below Transversely across head and back 8 bands of drab, wide as interspaces, not in adult Spinous dorsal membranes edged black Caudal and pectoral brownish, other fins paler Length 200 to 300 mm

Natal, two specimens

Serranus sonnerati Valenciennes

Depth 2½ to 2¾, head 2⅗ to 2⅔, width 1⅘ to 2⅛, snout 3 to 3½, from snout tip, eye 6 to 7¼, 2 to 2⅛ in snout, equals bony, level interorbital, maxillary 2 in head, extends little beyond eye, expansion 1¾ to 1⅘ in snout, teeth triserial along sides of mandible, preopercle edge minutely and feebly serrated Rakers 9 + 16, lanceolate Scales 110 + 15, tubes 68 + 5, 20 scales above, 36 below, 65 predorsal to nostrils, maxillary naked or upper half minutely scaled, 6 to 10 basal striae, 46 to 50 apical points with 4 rows of basal segments D. IX, 15, I, fourth spine 3¼ in total head length, fourth ray 2⅓ to 2½, A III, 9, I, third spine 3, fourth ray 2, caudal 1¾ to 1⅔, convex behind, pectoral 1⅓ to 1⅔, ventral 1⅗ to 1¾ Pale uniform brown Soft vertical fins edged narrowly dusky Length 332 to 337 mm.

Natal, two specimens.

Serranus modestus (Gilchrist and Thompson)

Depth 3, head 2½, width 2, snout 3⅓, from snout tip, eye 6, 1¾ in snout, 1⅓ in interorbital, maxillary 2¼ in head, to hind pupil edge, expansion 1⅗ in eye, upper teeth in 4 or 5 rows and outer enlarged series, several inner enlarged and depressible, lower teeth in 4 rows, laterally enlarged inner row and single outer row, interorbital 5½ in head, broadly convex, hind preopercle edge finely serrated, 6 or more denticles little enlarged at angle, median opercular spine closer to lower and well behind upper Rakers 7 + 17, lanceolate. Scales 102, tubes 71 + 3, 20 scales above, 30 below, 76 predorsal, hind half of maxillary scaly, 8 to 10 basal striae, apical points 28 to 33 with 2 or 3 rows of basal segments D XI, 16, I, third spine 3 in total head length, first ray 3⅓, A III, 8, I, third spine 4⅖, third ray 2⅗, caudal 1⅗, truncate, caudal peduncle depth 4⅓; pectoral 2, ventral 2⅓. Above broccoli brown, ecru drab below. Vertical fins little darker than back, lower anal edge broadly whitish Pectoral pale, whitish below terminally Ventral largely slaty, basally and marginally whitish Length 407 mm

Pondol and Cape trawl, 140 fathoms

Serranus caeruleopunctatus (Bloch)

Depth 2⅞, head 2⅓, width 2½, snout 4⅞, from snout tip, eye 4⅞, maxillary 2¼, *to hind eye edge, expansion ½ eye, upper teeth in* 4 rows with outer enlarged, lower 2 or 3 rows with outer enlarged, interorbital 7⅓ in head, convex, hind preopercle edge finely serrate, 5 large teeth just above angle, median opercular spine most posterior Rakers 7 + 14, lanceolate. Scales 94 + 10, pores 53 + 7, 12 scales above, 29 below, 50 predorsal, 20 rows across cheek to preopercle edge, maxillary naked, 5 or 6 basal striae, 26 to 32 apical points with basal segments in 7 or 8 rows D XI, 16, I, third spine 3 in total head length, fifth ray 2⅗, A III, 8, I, second spine 4, fifth ray 2½, caudal 1⅞, convex behind, caudal peduncle depth 3⅘, pectoral 1⅗, ventral 2⅛ Deep sepia, with 6 transverse obscure dark bands Below, sides of head, chest and breast, reticulated broadly with deep brown, leaving large, scattered, pale blotches, 3 pairs on mandible below Blackish streak in maxillary groove. Pectoral base with dark brown blotch, fin pale gray terminally Other fins dusky terminally, dark bands on trunk extending on dorsals. Length 180 mm

Natal coast

Serranus rivulatus Valenciennes

Depth 2¾, head 2¼, width 2⅓; snout 4⅗, from snout tip, eye 4⅗, maxillary 2¼ to hind eye edge, expansion 1¾ in eye, upper teeth 4 or 5 rows and outer enlarged row, 2 rows along side of mandible, becoming uniserial behind, band of conic teeth broad angled on vomer and biserial on palatines, interorbital 8⅓ in head, slightly concave, hind preopercle edge finely serrate, lower edge entire, median opercular spine most posterior Rakers 7 + 15, lanceolate Scales 92 + 7, pores 52 + 4, 11 scales above, 30 below, 48 of larger on predorsal, maxillary naked, 5 to 7 basal striae with 3 auxiliaries, 32 to 38 apical points, with 4 rows of basal segments D XI, 17, I, fourth spine 3 in total head length, sixth ray 3⅛; A III, 8, I, second spine 3¾, sixth ray 3, caudal 1⅞, convex behind, caudal peduncle depth 4⅛, pectoral 1¾, ventral 2⅓ Dull brown, each scale with darker spot, paler below. Several dark brown streaks radiate from lower hind eye edge Blackish line along dorsal base Fins pale dusky terminally Length 298 mm

Durban, 40 fathoms

Boulenger's account of the type agrees very well, except it has one more dorsal spine I can hardly believe this of specific value as I occasionally find the dorsal spines vary in species of *Serranus* *Epinephelus grammatophorus* Boulenger[4] would then fall a synonym

Serranus tauvina (Forskål)

Depth 3⅓, head 2½, width 2⅔, snout 3¼, from snout tip, eye 7, maxillary 2⅒, little beyond eye, expansion equals eye, 3 rows of mandibular teeth, interorbital 7 in head, nearly level, hind preopercle edge serrate, lower entire Rakers 9 + 17, lanceolate Scales 93 + 12, tubes 50 + 5, 12 scales above, 26 below, 82 predorsal, 33 across cheek, upper ⅔ of maxilary expansion finely scaled, 6 to 8 basal striae and 1 or 2 auxiliaries, circuli 40 D XI, 15, I, fourth spine 3⅗ in total head length, third ray 3⅛, A III, 8, I, second spine 4¾, fifth ray 3, caudal 2, convex behind, caudal peduncle depth 3⅝, pectoral 1⅛, ventral 1⅝ "Body pale mauve, darker on back. Belly white, spotted with vandyke or red brown, belly spots redder Dorsal white and pale gray, with spots over spines Pectoral, caudal, anal and lower dorsal whitish, with pale blue Pectoral with shades of yellow and small spots at base Eye deep olive and with golden ring" Length 270 mm

Durban Bay

Aulacocephalus temminckii Bleeker

Depth 3, head 2½, width 3, snout 2⅓, from snout tip, eye 7¼, 2⅗ in snout, maxillary 2 in head, to hind pupil edge, expansion equals eye, teeth in 5 or 6 rows above and 3 or 4 below and both jaws with outer enlarged row, interorbital 6⅓ in head, convex, preopercle edge irregularly denticulate, interorbital, occiput and preorbital with fine striae, median opercular spine with several small terminal serrae, opposite lowest spine. Rakers 6 + 18, lanceolate. Scales 92 + 6, tubes 64 + 4, 7 scales above, 26 below, 25 predorsal to occiput, 15 rows across cheek to preopercle angle, vertical fins, except caudal base narrowly, scaleless, 11 of 12 basal striae, 8 to 12 apical points with 2 or 3 rows of basal elements D IX, 12, I, third spine 3⅗ in total head length, second ray 3, A III, 9, ɪ, third spine 6⅓, second ray 2⅞, caudal 2⅓, truncate, pectoral 2⅔, ventral 2⅘ "Back black Belly and sides plum blue Lemon yellow stripe along back Tail bluish." Length 300 mm

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[4] Ann S Af Mus., 13, 1905, p 64, Pl 3 Natal

Natal coast, 25 fathoms

ANTHIINAE

Sacura natalensis new sepcies Text figure 2

Depth 2⅓, head 2⅗, width half its length Snout 3⅘ in head, from snout tip, eye 4⅓, $1\frac{1}{16}$ in snout, 1⅖ in interorbital, maxillary reaches opposite eye center, expansion 1⅓ in eye, length 2 in head, teeth uniformly fine, in bands in jaws, on vomer and palatines, interorbital convex, 2⅘ in head, hind preopercle edge with obsolete minute serrae Gill-rakers 10 + 24, lanceolate

Scales in lateral line 42 tubular to caudal base, 9 above to spinous dorsal origin, 18 below, 38 predorsal Tubes in lateral line rather large, simple Scales with 5 to 8 incomplete, short, marginal striae and many as 15 incomplete submarginal, apical denticles 75 to 87, uniserial, circuli minute.

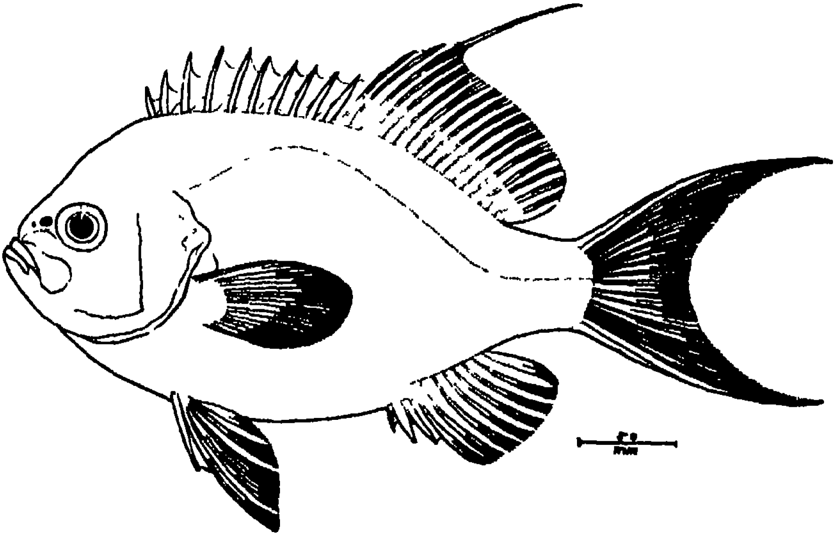

Figure 2 —*Sacura natalensis* new species

D X, 18, ɪ, fifth spine 3⅘ in total head length, third ray filamentous and reaches caudal base, A III, 8, ɪ, third spine 3⅓, first ray 2⅓, pectoral 1⅓, ventral 1⅓, caudal deeply emarginate, lobes each end in long slender filament, total length 2⅓ in combined head and body. Uniform pale brownish, likely rosy in life Length 438 mm

Natal coast, in 25 fathoms.

Differs from the Japanese *Sacura margaritacea* (Hilgendorf), as figured by Tanaka,[6] in the less spinescent preopercle edge, short anal spines and more scaly vertical fins, besides the third dorsal spine is not prolonged or only slightly shorter than the fourth Also the hind nostril is greatly larger than the front one

PRIACANTHIDAE

Priacanthus hamrur (Forskål)

Depth 2⅝, head 3, width 2, snout 3⅛, from snout tip, eye 2⅜, maxillary 2, to eye center, expansion 2 in eye, outer enlarged row of jaw teeth, besides 2 or 3 rows above and 3 or 4 below, narrowing uniserial behind, interorbital 4⅛ in head, convex, preopercle edge minutely serrate, with broad flat spine at angle Rakers 5 + 20, lanceolate Scales 77 + 5, 11 above, 28 below, 53 predorsal, 10 rows on cheek to obsolete angle of preopercle ridge, 3 to 6 basal lobes and 19 to 23 apical denticles in 4 or 5 series transversely D. X, 13, I, fourth spine 2¼ in total head length, fourth ray 1¾, A III, 14, I, third spine 2¼, fifth ray 1⅗, caudal 1¼, slightly concave behind, truncate expanded, caudal peduncle depth 4, pectoral 1¾, ventral 1⅛ Back drab, below ecru drab or vinaceous buff Iris slate, pupil rosy purple Fins pale, like body Ventral dusky Length 238 mm

Tugela River, in 60 fathoms

PEMPHERIDAE

Pempheris mangula Valenciennes

Depth 2⅛ to 2⅓, head 3⅛ to 3¼, width 1⅝ to 2, snout 4½ to 5, eye 2⅛ to 2¼, maxillary 1⅘ to 1⅞, to first ⅔ in eye, expansion 3 in eye, interorbital 3⅛ to 3⅜, broadly convex Rakers 9 + 21, finely lanceolate Tubes 55 or 56 in lateral line and 17 more out over caudal base D VI, 9, I, sixth spine 1⅓ to 1⅝ in head, first ray 1⅛ to 1¼, A. III, 37, I to 41, I, third spine 3⅛ to 4⅕, first ray 2⅒ to 2⅛, caudal 1 to 1⅜, forked, pectoral 1⅒, ventral 1⅞ to 2⅒ Ecru drab to vinaceous or heliotrope purple, silvery white on lower side of head, iris, breast and belly Dorsal grayish, dusky neutral to blackish terminally Anal dotted with gray and dark gray, edge more gray Caudal dark gray, dusky behind Paired fins whitish, without dark blotch at pectoral base Length 73 to 128 mm

Natal, five specimens.

Pempheris otaitensis Valenciennes, though united with the present species by Day, differs in the dark external blotch at pectoral base.

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[6] Fishes of Japan, vol. 31, June 27, 1921, p 559, Pl 42, fig. 395

LUTJANIDAE

Lutjanus johnii (Bloch)

Depth 2⅜ to 3⅛, head 2½ to 2⅝, width 2⅝ to 2½, snout 2¾ to 3⅛, eye 4 to 7, 1⅛ to 1¾ in snout, maxillary 2¼ to 2½ in head, to eye (to eye center in young), expansion 1¼ to 2 in eye, canines ⅔ to ¼, interorbital 5 to 5¼, convex, preopercle edge denticulate, denticles little larger around angle Rakers 5 to 7 + 10 to 14, lanceolate Scales 46 to 49 + 6 to 10, 7 or 8 above, 12 to 15 below, 11 to 15 predorsal, 6 rows on cheek, 64 or 65 basal striae (10 to 12 in young) and 185 apical points (75 to 78 in young) with basal segments in 30 series (4 to 7 in young) D X, 13, I, fourth spine 2¼ to 3 in head, first ray 2⅞ to 3⅛, A III, 8, I, second spine 2⅜ to 2⅞, first ray 2¼ to 2⅝, caudal 1⅝ to 1⅜, emarginate, caudal peduncle depth 3¼ to 3⅜, pectoral 1⅛ to 1⅓, ventral 1⅔ to 1⅘ "Coppery red, scales dark edged Belly white and pale red Head greenish above, gill-flaps red brown Eye bright red above. Caudal reddish brown Dorsals brownish Pectoral bright red" Young with neutral dusky blotch, little smaller than eye, below front of soft dorsal, close on and below lateral line. Length 125 to 517 mm

Three from Natal and two from Delagoa Bay

Lutjanus rivulatus (Cuvier)

Depth 2⅓, head 2⅝, width 1⅝, snout 2⅘, eye 6, 2⅓ in snout, 1⅝ in interorbital, maxillary 2⅓ in head, to hind nostril edge, expansion 1⅓ in eye, interorbital 4 in head, convex, hind preopercle edge finely serrated, gash above lower angle receiving slight bony opercular knob Rakers 5 + 10, lanceolate Scales 55 + 18, tubes 49 + 4, 9 scales above, 19 below, 11 predorsal to occiput and 2 more separated still forward, 7 rows of scales across cheek to preopercle ridge, 13 to 18 basal striae, apical points 85 to 90 with 4 to 8 rows of basal segments D X, 16, I, fifth spine 3⅓ in head, ninth ray 2⅘, A III, 8, I, second spine 3⅘, fourth ray 2⅓, caudal 1⅔, slightly emarginate, caudal peduncle depth 3, pectoral 1⅓, ventral 1⅔. "On cheek, behind eye, some irregular pale violet lines on bright yellow Some salmon beneath opercle, gamboge scales edged brown, with pale blue dot at base Belly paler, white dots not distinguishable Dorsal gamboge, soft rays of body coloring Caudal with upper half gamboge Anal gamboge, with olive membrane. Ventral gamboge, with some yellow Eyes pinkish, with pale violet" Small deep brown spot at pectoral origin. Length 320 mm

Natal coast, in shore

POMADASIDAE

Plectorhinchus durbanensis (Gilchrist and Thompson)

Depth 2¼, head 3, width 2, snout 3⅛, eye 3, maxillary 3⅓, to eye, expansion 2⅘ in eye, teeth 3 or 4 rows and outer enlarged row, interorbital 4 in head, broadly convex, 3 large pores each side of mandible close to lower edge of lip, hind preopercle edge denticulate, lower edge entire Rakers 13 + 22, lanceolate Scales 70, tubes 52 + 10, 9 scales above, 18 below, 44 predorsal, 24 across cheek to preopercle angle, 6 to 8 basal striae, apical points 34 to 46, with 3 to 7 rows of basal segments D XII, 19, I, fourth spine $2\frac{1}{5}$ in head, first ray $2\frac{3}{5}$, A III, 7, I, second spine $1\frac{7}{8}$, third ray $1\frac{4}{5}$, caudal $1\frac{1}{5}$, truncate, slightly emarginate as contracted, caudal peduncle depth $2\frac{4}{5}$, pectoral $1\frac{1}{4}$, ventral $1\frac{3}{5}$ Dark brown, little paler below Lips pale, iris brown Fins neutral dusky terminally. Length 132 mm

Delagoa Bay.

Owing to youth, the maxillary scales in the original account are not evident

Plectorhinchus foetela (Forskål)

Depth $2\frac{2}{3}$, head $2\frac{7}{8}$ to 3, width $2\frac{1}{5}$, snout $2\frac{1}{2}$ to $2\frac{3}{4}$, eye $3\frac{1}{3}$ to $3\frac{1}{2}$, $1\frac{1}{4}$ to $1\frac{1}{3}$ in snout, maxillary $3\frac{1}{5}$ to $3\frac{2}{5}$ in head, not to eye, expansion $2\frac{1}{5}$ to $2\frac{2}{5}$ in eye, teeth in 3 or 4 rows and outer enlarged row, interorbital $3\frac{7}{8}$ to 4 in head, convex, 3 large pores each side of mandible below lower lip, hind preopercle edge denticulate, lower entire. Rakers 14 + 18, lanceolate Scales 79, tubes 48 to 52 + 6 to 8, 11 scales above, 18 below, 30 predorsal, 23 across cheek to preopercle angle, 7 or 8 basal striae, 39 to 49 apical points with 5 to 8 rows of basal segments D XIII, 21, I, third spine $2\frac{3}{5}$ to $2\frac{4}{5}$ in head, first ray $2\frac{4}{5}$ to 3, A III, 6, I, or 7, I, second spine $2\frac{1}{4}$, second ray $1\frac{7}{8}$ to 2, caudal $1\frac{1}{5}$ to $1\frac{2}{5}$, slightly emarginate, truncate when expanded, caudal peduncle depth $3\frac{1}{10}$ to $3\frac{1}{4}$, pectoral $1\frac{2}{5}$ to $1\frac{3}{5}$, ventral $1\frac{3}{5}$ Dusky generally. Head with 8 horizontal golden bands Trunk and top of head all closely spotted with golden Dusky dorsals with 2 rows of golden spots Caudal and anal with golden spots Paired fins dusky terminally Length 145 to 160 mm.

Delagoa Bay, two specimens.

Plectorhinchus reticulatus (Günther)

Depth $2\frac{1}{4}$, head 3, snout $2\frac{3}{4}$, eye $3\frac{3}{4}$, maxillary $3\frac{2}{5}$, to hind nostril, expansion $2\frac{3}{5}$ in eye, teeth irregularly biserial forward, biserial laterally, interorbital $4\frac{1}{10}$ in head, convex, hind preopercle edge denticulate Rakers 14 + 18, lanceolate Scales 80 + 12, tubes 55 + 10, 11 scales above, 18 below, 37 predorsal, 7 basal striae, 35 to 38 apical points with 3 or 4 rows of basal segments D XIII, 21, I, fifth spine $2\frac{3}{5}$ in head, seventh ray $2\frac{1}{10}$, A III, 7, I, second spine $2\frac{1}{5}$, second ray 2, caudal $1\frac{3}{5}$, truncate, caudal peduncle depth $2\frac{1}{5}$, pectoral $1\frac{1}{2}$, ventral $1\frac{3}{5}$. "Dark blue gray, with spots and bars of yellow over body and face Some on dorsal fin and lower dorsal soft rays, have besides gray dots mixed with yellow Caudal gamboge. Anal streaked with gray and gamboge Ventral yellowish Eye silvery, with dark gray above and little yellow in places" Length 128 mm

Delagoa Bay.

The transverse squamation, given as 13 scales above lateral line and 25 below by Günther, was based on an example 280 mm long Known otherwise only from China

Pomadasis bennetti (Lowe)

Depth $2\frac{3}{5}$, head $2\frac{2}{5}$, width 2, snout 3, eye 4, maxillary $3\frac{1}{4}$, to eye, teeth in bands in jaws, interorbital $4\frac{1}{3}$, convex, preopercle edge denticulate Rakers 6 + 15, lanceolate Scales 42 + 5, 9 above, 14 below, 33 predorsal, oblique rows above lateral line, horizontal rows below D XII, 15, I, fourth spine $2\frac{1}{3}$ in head, first ray $3\frac{1}{3}$, A III, 11, I, second spine $3\frac{1}{3}$, first ray 3, caudal $1\frac{1}{4}$, emarginate, pectoral $1\frac{1}{3}$, ventral $1\frac{3}{5}$ Pale olive above, silvery beneath Black blotch, size of pupil, on opercle Length 195 mm

Tugela River, in 60 fathoms

Pomadasis striatus (Gilchrist and Thompson)

Depth $2\frac{2}{5}$, head 3, width $1\frac{1}{3}$, snout 3, eye $3\frac{3}{4}$, $1\frac{1}{5}$ in snout, $1\frac{1}{10}$ in interorbital, maxillary $3\frac{1}{3}$ in head, to hind nostril, expansion 3 in eye, 2 mandibular pores followed by groove, upper teeth in 2 or 3 rows and lower 4 or 5, each jaw also with outer enlarged row, interorbital $3\frac{1}{3}$ in head, broadly convex, preopercle edge denticulate Rakers 7 + 10, lanceolate Scales 52 + 6, 6 above, 14 below, 33 predorsal, 6 or 7 basal striae, 45 to 60 apical points with 3 to 5 rows of basal segments D XII, 14, I, fourth spine $2\frac{1}{3}$ in head, second ray $2\frac{2}{3}$, A III, 8, I, second spine $2\frac{2}{5}$, first ray $2\frac{1}{3}$, caudal $1\frac{2}{5}$, emarginate, pectoral $1\frac{1}{4}$, ventral $1\frac{3}{4}$ Above dull purplish brown Four dark horizontal lines, lowest back from pectoral axil Opercle blackish blotch little less than eye Iris whitish Spinous dorsal gray, with white spot at base of each membrane Soft dorsal and caudal gray, former whitish basally Other fins whitish Length 160 mm

Delagoa Bay

The original account of this species gives 12 scales above the lateral line and 18 below I have not found any species of the genus with such an increased number and wonder if 12 is not erroneous? My example shows an additional dark longitudinal band from the pectoral axil and a large dark opercular blotch It has much the appearance of *Pomadasis nageb*, as figured by Day, though the preorbital scales are more advanced than in any other species

Pomadasis maculatus (Bloch)

Depth $2\frac{3}{4}$ to $2\frac{7}{8}$, head $2\frac{7}{8}$ to 3, width $1\frac{7}{8}$ to 2, snout 3 to $3\frac{1}{3}$, eye $3\frac{3}{5}$ to $3\frac{7}{8}$, $1\frac{1}{5}$ to $1\frac{1}{3}$ in snout, equals interorbital, maxillary $2\frac{1}{5}$ to 3 in head, to eye or front pupil edge, expansion $2\frac{3}{4}$ to 3 in eye, 2 mandibular pores followed by pit joined by branchiostegal groove, upper teeth in 3 or 4 rows, lower 4 or 5, and outer enlarged row in each jaw, interorbital 3⅞ to 3⅝ in head, broadly convex, preopercle edge denticulate. Rakers 7 + 14, lanceolate Scales 50 or 51 + 5 to 11, 5 above, 13 below, 30 to 34 predorsal, 9 basal striae, 23 to 45 apical points with 8 rows of basal segments D XII, 13, I or 14, I, fourth spine 1¾ in head, first ray 2⅕ to 2½, A III, 7, I, second spine 2 to 2⅜, first ray 2⅒ to 2⅜, caudal 1⅓ to 1⅜, emarginate, caudal peduncle depth 3 to 3⅜, pectoral 1 to 1⅒, ventral 1⅓ to 1½ Purplish brown above, with 4 broad deeper to blackish brown saddles from dorsal fins Spinous dorsal dusky gray, with large blackish median blotch Soft dorsal whitish basally, with narrow subbasal dusky streak and fin broadly dusky terminally Caudal brown, dusky terminally Other fins whitish, with dusky gray at anal front Length 140 to 155 mm

Delagoa Bay, two specimens

Pomadasis opercularis (Playfair)

Depth 3, head 2⅓, width 2½, snout 2⅓, eye 4, 1⅜ in snout, equals interorbital, maxillary 3⅒ in head, to nostril, expansion 3 in eye, mandible with pit below, upper teeth in 4 or 5 rows, lower 5 or 6 and each jaw with outer enlarged row, interorbital 4½ in head, convex, hind preorbital edge denticulate Rakers 7 + 15, lanceolate Scales 54 + 4, 7 above, 15 below, 37 predorsal, 8 to 12 basal striae, 9 to 25 apical points with 7 to 9 rows of basal segments D XII, 13, I, fourth spine 1¾ in head, first ray 2½, A III, 8, I, second spine 1⅜, first ray 2⅒, caudal 1¼, emarginate, caudal peduncle depth 3⅜, pectoral 1⅕, ventral 1⅜ Back brown, whitish below On back 5 or 6 irregular longitudinal rows of dusky brown spots, lowest level with eye Spinous dorsal dark gray, with basal neutral dusky blotch and membranes terminally dark Soft dorsal pale, terminal half and subbasal longitudinal band dark Anal dusky gray forward, pale behind Caudal dusky behind, otherwise brownish Paired fins pale Length 170 mm

Delagoa Bay

Pomadasis hasta (Bloch)

Depth 2⅜ to 2⅘, head 2⅜ to 2⅝, width 2⅕ to 2⅓, snout 3⅓ to 4, eye 3⅘ to 5, 1⅓ to 1½ in snout, equals interorbital, maxillary 2¾ to 3 in head, to eye, expansion 1⅓ to 2 in eye, mandible with symphyseal slit below, upper teeth in 3 or 4 rows and outer row enlarged, lower teeth similar, except outer row enlarged sometimes double, interorbital 4⅜ to 5 in head, convex, hind preopercle edge finely denticulate Rakers 7 + 13, lanceolate Scales 44 to 46 + 8 to 11, 4 or 5 above, 10 to 12 below, 35 to 44 predorsal, 11 or 12 basal striae, apical denticles 49 to 86 with basal elements in 7 to 12 rows. D. XII, 13, I or 14, I, fourth spine 1⅓ to 2 in head, fourth ray 2⅓, A III, 7, I, second spine 1⅘ to 1 9/10, first ray 2⅒ to 2⅕, caudal 1⅓ to 1⅜, slightly emarginate behind, caudal peduncle depth 3¼ to 3⅝, pectoral 1⅓ to 1⅗, ventral 1⅕ to 1⅜. Back brown, pale below

Back with 6 broad transverse dusky bands, each formed of 5 horizontal short dusky bars Opercle with dusky blotch. Spinous dorsal membranes neutral dusky, with row of subbasal whitish spots, 1 to each membrane and base narrowly blackish Soft dorsal with marginal, medial and basal dusky bands, otherwise gray brown Faint light brown transverse bar across ventral Fins otherwise pale or whitish Length 96 to 218 mm

Two from Delagoa Bay

Pomadasis guoraka (Cuvier)

Depth 2⅘, head 2⅗, width 2, snout 3¼, eye 5¼, 1½ in snout, 1⅗ in interorbital, maxillary 3, in head, to eye center, mandible with symphyseal pit, 4 or 5 rows of upper teeth and outer enlarged row, lower teeth in band and outer enlarged single or double row, interorbital 3⅗ in head, convex, hind preopercle edge finely denticulate Rakers 6 + 12, lanceolate. Scales 48 + 5, 4 above, 11 below, 18 predorsal to occiput, 40 to eye front, 10 or 11 basal striae and 3 to 6 auxiliaries, 35 to 117 apical points with 6 to 8 rows of basal segments D. XII, 10, i, fourth spine 2 in head, fourth ray 3, A. III, 7, i, second spine 2⅗, first ray 2⅘, caudal 1⅗, slightly lunate behind, caudal peduncle depth 4, pectoral 1¼, ventral 1⅗ Back pale brown, below white. Upper hind opercle angle in dusky blotch size of pupil Iris pale brown above Obscure brown band across head just behind eyes and another narrower across occiput. Dorsals, caudal and pectoral pale, dark gray terminally, other fins whitish Length 359 mm.

Delagoa Bay

Not previously reported from southeast Africa

THERAPONIDAE

Therapon jarbua (Forskål)

Depth 2⅘, head 2⅘, width 3, snout 3½, eye 4⅘, 1⅓ in snout, 1¼ in interorbital, maxillary 3 in head, ⅘ in eye, expansion 2 in eye, teeth in 4 or 5 rows and outer enlarged row, interorbital 3⅓ in head, slightly elevated, level Rakers 6 + 13, lanceolate Scales 76, 16 above, 23 below, 18 predorsal, 11 rows across cheek to preopercle ridge, 8 to 12 basal striae, 18 to 27 apical points with 3 to 5 rows of basal segments D XII, 10, i, fourth spine 1⅘ in head, second ray 2⅓, A III, 8, i, third spine 2⅗, second ray 2⅓, caudal 1⅓, deeply emarginate, caudal peduncle depth 3; pectoral 2; ventral 1⅘ Purplish gray above, white below. Dusky neutral to blackish band from spinous dorsal origin to front of soft dorsal base, another from predorsal parallel to caudal peduncle front, third from suprascapula to caudal base medianly Iris dusky. Dorsal pale, large black terminal blotch on spinous dorsal and smaller on soft dorsal. Caudal pale, upper lobe with black tip and longitudinal black band across lobe and similar one on lower lobe. Length 166 mm

Delagoa Bay.

Therapon quadrilineatus (Bloch)

Depth 2⅝ to 3⅛, head 3⅛ to 3¼, width 3⅛ to 3¼, snout 2⅝ to 3, eye 3⅛ to 3½, 1 to 1⅛ in snout, equals interorbital, maxillary 3⅓ to 3½ in head, to hind nostril or eye, expansion 2⅓ to 2½ in eye, teeth in 3 or 4 series and outer enlarged row, interorbital 3⅓ to 3⅞ in head, broadly convex Rakers 16 to 21 + 20 to 24, lanceolate Scales 75 to 84 + 8, tubes 58 to 60 + 4 to 9, 11 to 15 scales above, 21 or 22 below, 16 or 17 predorsal, 4 or 5 rows on cheek, 12 to 20 basal striae with 3 or 4 auxiliaries, 19 to 29 apical points with 3 or 4 rows of basal segments D. XII, 10, I, fifth spine 1⅜ to 1⅞ in head, second ray 2 to 2⅒, A III, 10, I, third spine 2⅛ to 2⅓, second ray 1¾ to 2, caudal 1⅓, emarginate, caudal peduncle depth 3⅒ to 3⅛, pectoral 1⅓ to 1½, ventral 1⅓ to 1⅝ "Five distinct olive brown lines along body, over head and snout, median broadest Above opercle black spot, transparent, with black edging Anal gamboge below Ventral yellow Caudal gamboge, with darker on rays Iris chrome yellow" Length 140 to 150 mm

Delagoa Bay, three examples

SPARIDAE

Dipterodon capensis Valenciennes

Depth $1\frac{9}{10}$, head 3⅞, width 1⅞, snout 3, eye 4, 1⅝ in snout, equals interorbital, maxillary to eye, expansion 2½ in eye, teeth uniserial incisors, hind preopercle edge serrated Rakers 8 + 15, lanceolate Scales 88, tubes 69, scales 28 above, 33 below, 60 predorsal, 15 rows across cheek, 12 to 18 basal striae, 40 to 53 apical points with 3 to 7 transverse basal series of segments D X, 22, I, fourth spine 2⅓ in head, third ray 1½, A III, 14, I, second spine 3⅛, third ray 1½, caudal 1, deeply emarginate, pectoral 1⅓, ventral 1¼ Olive, fawn color below On side 9 vertical deep clove-brown bands, each little narrower than interspaces, within which parallel alternate clove-brown vertical line Fins neutral dusky, ventral especially dark terminally Length 215 mm

Natal coast

Figured and described originally as uniform brown, from an example 442 mm long, with depth 2⅛

Diplodus capensis (Smith)

Depth 2⅛, head 3⅓, width $1\frac{9}{10}$, snout 2⅝, eye 3⅔, 1⅝ in snout, 1⅓ in interorbital, maxillary 3 in head, to hind nostril, expansion 2¾ in eye, incisors $\frac{8}{8}$ and molars triserial above and below, interorbital 3, convex Rakers 7 + 10, lanceolate Scales 63 + 9, 9 above, 18 below, 25 predorsal, 6 rows on cheek to preopercle ridge, 9 to 12 basal striae, apical points 85 to 92 with 6 or 7 rows of basal segments D. XII, 15, I, fifth spine 2⅝ in head, first ray 2¾, A III, 13, I, second spine 3, first ray 3; caudal 1, forked, ventral 1⅓, pectoral 3 ? in combined head and body. Brown, with broad blackish saddle on upper side of caudal peduncle Pectoral axil blackish and small blackish spot at fin origin Outer portions of ventral and soft vertical fins with dusky gray Length 188 mm.

Natal

Diplodus nigrofasciatus (Regan)

Depth 2⅕, head 3⅕, width 2, snout 2⅗, eye 3⅕, 1⅕ in snout, 1⅕ in interorbital; maxillary 2⅓ in head, to front pupil edge, expansion 2⅕ in eye, incisors 8/8, upper molars triserial, lower biserial, interorbital 2¾ in head, broadly convex. Rakers 7 + 10, lanceolate Scales 53 + 5, 5 above, 12 below, 24 predorsal, 5 rows across cheek, 13 to 15 basal striae, 40 obsolete apical points with 2 or 3 rows of basal segments D. XI, 13, I, fourth spine 2 in head, first ray 2⅗, A III, 11, I, second spine 2¼, first ray 2⅗, caudal 1, well forked, caudal peduncle depth 2¾; ventral 1¼, pectoral 2⅘ in combined head and body Olive brown above, below whitish. Iris silvery white, with neutral blotch above Each row of scales with darker brown longitudinal line than ground color Dorsals grayish, with neutral dusky subbasal longitudinal lines Caudal gray, edges dusky behind. Other fins whitish Length 150 mm

Delagoa Bay

Except the absence of 6 or 7 vertical blackish bars, described from an example 360 mm long by Regan, my example agrees in most every other way.

Sparus spinifer Forskål

Depth 1⅞, head 2⅘, snout 2⅗, eye 3, maxillary 2⅗, expansion 3 in eye, to eye, teeth biserial, front ones conic, posterior molars, interorbital 3⅗ in head, widely convex Rakers 7 + 10, lanceolate Scales 52 + 4, 8 above, 16 below, 18 predorsal, 4 rows on cheek, 8 or 9 basal striae, 30 to 32 apical points. D XII, 11, I, third to sixth spines end in long, slender, filaments with third longest or reaching well beyond caudal, as long as entire fish, second ray 2⅕ in head, A III, 8, I, second spine 2⅗, first ray 2¼, caudal 1⅒, emarginate, caudal peduncle depth 2⅗, pectoral 1, ventral 1⅓. "Silvery, with faint pinkish on back and 4 or 5 broad pink bars across body Tail yellowish, other fins transparent Eye silvery, gray over top" Length 84 mm

Delagoa Bay.

Sparus lophus new species. Text figure 3

Depth 2⅒, head $2\frac{9}{10}$, width 2⅒ its length Snout 2⅕ in head, upper profile concave, eye 4, 1⅗ in snout, 1⅕ in interorbital, maxillary reaches opposite front eye edge, 3⅕ in head, expansion 3 in eye, canines 4/4, each side of each jaw 12 outer molar-like teeth, with last 5 enlarged, also band of inner granular teeth in jaws; interorbital 3⅕ in head, convex. Gillrakers 6 + 12, short, strong, lanceolate.

Scales 56 + 2 in lateral line, 9 scales above, 19 below, 50 predorsal, extend forward opposite front eye edge, cheek with 15 rows to preopercle ridge, flange also scaled Scales with 12 to 15 basal radiating striae, apical denticles 90 to 115, transverse basal elements in 4 to 13 series, circuli fine

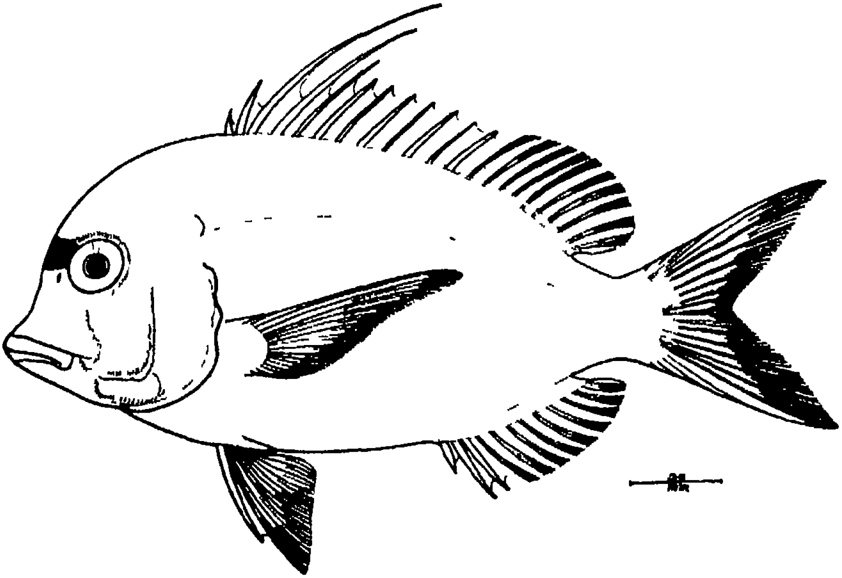

Figure 3 *Sparus lophus* new species.

D XII, 10, I, third spine 1 in head, fifth ray 2⅓, A III, 9, I, second spine 2⅔, first ray 2⅓, caudal 1, deeply emarginate, ventral 1⅔, pectoral 2⅓ in combined head and body

Pale uniform brown Brown band across front of interorbital. Length 263 mm

One from Natal coast, in 30 fathoms

Differs from all the South African species of the genus in the long slender third and fourth dorsal spines, which nearly or quite as long as the head. In many respects it agrees with Gunther's description of *Chrysophrys cristiceps*, but it is described with moderate dorsal spines[6] It bears a superficial resemblance to *Paragyrops edita* as figured by Tanaka,[7] though that fish has no scales on the preopercle flange. Its third to fifth dorsal spines are much longer than the head

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[6] Cat Fish. Brit Mus., 1, 1859, p. 486

[7] Fishes of Japan, Vol 24, Dec 4, 1916, p 425, Pl 117, fig. 343

Sparus dentatus (Gilchrist and Thompson)

Depth 2⅓, head 2⅞, width 1⅓, snout 2, from snout tip; eye 4⅔, 2⅔ in snout, 1⅔ in interorbital, maxillary 2⅓ in head, gape to hind nostril; outer series of 7 large molars, inner series of 5 irregularly smaller, interorbital 3, convex Rakers 9 + 12, lanceolate Scales 70 + 10, 15 above, 27 below, 73 predorsal, 10 rows on cheek to preopercle ridge, 9 basal striae, weak apical points 59 or 60 with 5 or 6 rows of basal segments D XIII, 10, I, fourth spine 3¼ in total head length, fourth ray 2⅔, A. III 9, I, second spine 3⅓, second ray 2⅞, caudal 1¼, emarginate, pectoral 1, ventral 1⅔ Head vinaceous, trunk and tail pinkish buff Mouse gray transverse band across front of interorbital, squamous area forward opposite front nostril Fins pale. Length 250 mm

Natal

Sparus holubi (Steindachner)

Depth 2⅓, head 3⅓, width 1⅝, snout 3⅓, eye 2¾, maxillary 2⅓, expansion 3⅔ in eye, teeth rather short, simple, conic, 3 or 4 series forward, narrowing to single series posteriorly and outer forward series moderately and evenly enlarged, interorbital 3½ in head, slightly convex Rakers 10 + 14, lanceolate Scales 55 + 7, 9 above, 15 below, 29 predorsal, 10 rows across cheek to preopercle ridge, 12 to 16 basal striae, with 3 auxiliaries, apical points 90 to 95 with 3 to 13 rows of basal segments D XI, 10, I, fifth spine 2½ in head, last ray 3⅓, A. III, 11, I, second spine 3¼, first ray 3⅓, caudal 1, emarginate, caudal peduncle depth 2⅗, ventral 1⅔, pectoral 3 in combined head and body "Silvery, scales edged brown Head, over upper jaw and behind eye, brownish pink Fins brown, upper quarter of pectoral brown, with brown patch at base Eye silvery" Length 233 mm

Natal coast, in 9 fathoms.

A strongly marked species, readily known by the dark crescentic band from the nape, back, and down to the opercles, and by the dark axillary pectoral spots, visible both above and below.

Sparus robinsoni (Gilchrist and Thompson)

Depth 2 to 2¼, head 2⅗ to 3, width 2 to 2⅒, snout 2⅗ to 3⅓, eye 3¾ to 4½, 1⅓ to 1⅗ in snout, 1⅔ in interorbital, maxillary 2⅔ to 2¾ in head, to eye center, expansion ½ of eye, canines ⅗, molars at least 2 rows in each jaw, usually 3 rows above and outer slightly higher row of short, strong, conic teeth, interorbital 3¼ to 4, convex. Rakers 6 + 10, lanceolate Scales 42 to 44 + 4 to 6, 4 above, 12 below, 16 to 19 predorsal, 6 rows on cheek, 13 or 14 basal striae, apical points 95 to 160 with 3 or 4 rows of basal segments. D XI, 11, I, fourth spine 1⅞ to 2 in head, fourth ray 2⅒ to 2⅓, A III, 9, I, caudal 1⅓ to 1¼, forked, caudal peduncle depth 2⅗ to 2⅘, ventral 1⅓ to 1⅓, pectoral 2⅔ to 2½ in combined head and body. Smutty purplish brown, lighter below Iris brown Lips pale. Fins neutral gray Anal in front and ventral terminally neutral black Small examples less smutty than adult and with pale fins Length 120 to 230 mm

Two from Delagoa Bay, and one from Natal

Resembles Day's figure of *Chrysophrys datnia*[8] My examples with little smaller anal spine He shows only forepart of anal blackish and gives scales 46 to 48 Klunzinger places *Chrysophrys datnia* Day as possibly synonymous with *Sparus berda* Forskål.

Sparus natalensis (Castelnau) Text figure 4

Depth $2\frac{1}{3}$, head $3\frac{1}{2}$, width $1\frac{9}{10}$, snout $2\frac{1}{4}$, eye 4, $1\frac{7}{8}$ in snout, $1\frac{1}{3}$ in interorbital, maxillary $2\frac{2}{3}$ in head, interorbital 3 Scales 57 + 2, 7 above, 13 below, 25 predorsal D XI, 12, I, third spine $3\frac{1}{10}$ in head, second ray 3, A III, 12, I, second spine $3\frac{1}{4}$, first ray $3\frac{1}{3}$, pectoral $2\frac{1}{3}$ in head and body combined, ventral $1\frac{4}{5}$ "Gold stripe through center of body" Back olive, sides and below whitish Blackish neutral spot at pectoral origin Length 270 mm

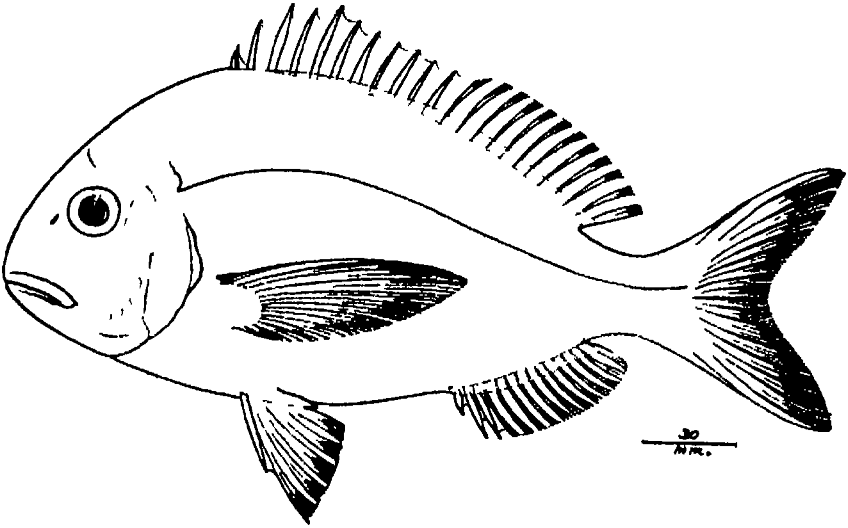

Figure 4 —*Sparus natalensis* (Castelnau)

Durban Bay

It has but few scales on the preopercle flange.

Pagrus laniarius Valenciennes.

Depth $2\frac{4}{5}$; head $2\frac{5}{8}$, width $1\frac{4}{5}$, snout $2\frac{7}{8}$, eye $3\frac{4}{5}$, maxillary $2\frac{7}{8}$, not to eye, canines $\frac{4}{4}$, bands of fine teeth forward in jaws, short and biserial posteriorly, with inner molar and outer lower conic, inter-

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[8] Fishes of India, 1, 1875, Pl 34, fig. 1

orbital 3⅔ in head, slightly convex Rakers 8 + 12, lanceolate. Scales 57 + 9, 8 above, 17 below, 36 predorsal, 8 rows across cheek to preopercle ridge, 10 or 11 basal striae, 76 to 81 apical points with 2 to 4 rows of basal segments D XII, 9, I, fifth spine 3 in head, first ray 4, A III, 8, I, second spine 3⅕, first ray 4, caudal 1⅗, widely emarginate, caudal peduncle depth, 3⅘, pectoral 1⅐, ventral 1⅘ "Mauve pink, darker on back and over and behind eye. Some mauve and pink at corner of upper lip and above Pectoral, dorsal and anal pink at tips, caudal darker with pale gamboge on fringe Ventral pale mauve pink Anal darker Eye silvery, with pink Cheek and belly white." Length 207 mm

Port St John, Natal coast, 3 miles out, in 8 fathoms

Pagrus caffer Castelnau[9] is likely the same as *Pagrus nigripinnis* Boulenger as described by Gilchrist and Thompson with the vernacular "mussel-crusher." Castelnau describes the caudal ends black and the second anal ray [more likely the second anal spine] very strong

Pagellus affinis Boulenger

Depth 2⅘ to 3, head 3 to 3⅕, width 2 to 2⅕, snout 3, eye 3⅕ to 3⅗, 1⅕ to 1⅗ in snout, 1 to 1⅕ in interorbital; maxillary 2⅘ to 3 in head, to eye, expansion 2 to 2⅘ in eye, band of 5 or 6 rows of fine teeth in jaws, posteriorly 5 or 6 biserial molars with inner row more blunt, also outer enlarged conic row of teeth, interorbital 3⅕ to 3⅗ in head, broadly convex Rakers 7 + 11, lanceolate Scales 56 or 57 + 5, 4 to 7 above, 14 or 15 below, 26 to 30 predorsal, 5 or 6 between eye and preopercle flange, muzzle, preopercle flange, front half of interorbital and superciliaries naked, 7 to 10 basal striae, 67 to 103 apical points, with 2 rows of basal segments D XII, 10, I, fourth spine 2⅗ to 3 in head, first first ray 3⅓ to 3⅘, A III, 10, I, second spine 4 to 4½, first ray 3½ to 4; caudal 1⅕ to 1¼, forked, caudal peduncle depth 3½, pectoral 1 to 1⅒, ventral 1⅗ to 1⅘ "Pinkish, belly silvery" Length 135 to 188 mm.

Delagoa Bay Natal coast, Tugela River mouth, in 60 fathoms

Pagellus mormyrus (Linné)

Depth 2⅘; head 2⅘, width 2, snout 2⅓, eye 4⅗, 2 in snout, 1⅕ in interorbital, maxillary 2½ in head, to hind nostril, expansion 3 in eye, upper teeth with outer enlarged row conic and inner band of fine anterior teeth, posteriorly 4 rows of molars, of which third largest and outer next in size, lower similar, only 3 rows of molars, interorbital 3⅘, broadly convex Rakers 9 + 15, lanceolate. Scales 56 + 4, 4 above, 13 below, 15 predorsal, 5 rows on cheek to preopercle ridge, muzzle, most of interorbital and preopercle flange naked, 8 or 9 basal striae, 53 to 72 apical points with 1 or 2 basal rows of segments D XI, 12, I, fourth spine 3 in head, first ray

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[9] Mém Poiss Afrique Austr, 1861, p. 30 Port-Natal

$3\frac{1}{8}$, A III, 10, I, third spine $4\frac{1}{8}$, first ray $3\frac{1}{8}$, caudal $1\frac{1}{4}$, deeply forked, caudal peduncle depth 3, pectoral $1\frac{3}{8}$, ventral $1\frac{4}{5}$. Brown, whitish below Above 14 vertical dusky streaks, alternately darker and paler Dorsals and caudal grayish, other fins whitish Length 165 mm.

Delagoa Bay

Dentex preorbitalis Gunther

Depth $2\frac{2}{3}$ to $2\frac{7}{8}$, head 3, width 2 to $2\frac{1}{3}$, snout 2 to $2\frac{1}{8}$, eye $4\frac{1}{2}$, 2 to $2\frac{1}{3}$ in snout, equals interorbital, maxillary $2\frac{3}{4}$ to $2\frac{4}{5}$ in head, to eye, expansion $1\frac{3}{4}$ to $1\frac{4}{5}$, canines $\frac{1}{4}$, single row of outer conic teeth, inner band of fine granular ones, interorbital $3\frac{7}{8}$ to $4\frac{1}{2}$, evenly convex. Rakers 10 to 12 + 15, lanceolate Scales 59 or 60 + 3 to 10, 12 or 13 above, 13 to 16 below, 62 to 66 predorsal forward to front nostril, 11 or 12 rows on cheek to preopercle ridge, flange also scaled, 9 to 13 basal striae, apical points 78 to 147 with 9 to 13 rows of basal elements D XII, 9, I or 10, I, fourth spine $2\frac{3}{4}$ to $2\frac{7}{8}$ in head, first ray $3\frac{1}{2}$ to $3\frac{7}{8}$, A III, 8, I, second spine $3\frac{1}{10}$, first ray $3\frac{1}{3}$, caudal $1\frac{1}{3}$ to $1\frac{2}{3}$, widely forked or lunate, caudal peduncle depth 3, pectoral $1\frac{1}{3}$ to $1\frac{1}{10}$, ventral $1\frac{7}{8}$ to $1\frac{9}{10}$ "Back, to lateral line, dark yellow, with broad blue band along ridge extending into lower dorsal Body with number of bright blue dots running into caudal base, dots larger and paler below lateral line Dorsal gamboge, tinged with pale violet Eye yellow, with blue streak over top and at side Fins pale mauve yellow, with shades of pale violet" Length 240 to 322 mm

Natal coast, two specimens, the smaller at 8 fathoms

Gilchrist and Thompson mention "eleven series of scales between the preorbital and the margin of the preoperculum," though my example clearly shows 16

Of other species *Dentex macrocephalus* Cuvier is largely uniform, spinous dorsal edge narrowly dark red and predorsal scales not forward to interorbital front *Dentex brevis* Kner has large blackish spots in above pectoral axil and sea gray bands, also its ventral and anal dark as upper fins It is described as *Dentex rupestris* by Günther *Dentex undulosus* Regan has a dark lateral blotch and a narrower preorbital *Dentex macrodus* Castelnau is very near *Dentex argyrozona*, but with a larger body, short equal anal spines, and enlarged canines

Dentex rupestris Valenciennes

Depth $2\frac{1}{4}$, head 3, width $2\frac{1}{4}$, snout $2\frac{1}{3}$, eye $4\frac{3}{5}$, 2 in snout, $1\frac{1}{2}$ in interorbital, maxillary $2\frac{3}{5}$ in head, to $\frac{1}{3}$ in eye, expansion $1\frac{3}{5}$ in eye, canines $\frac{4}{5}$, teeth uniserial, interorbital $3\frac{1}{2}$, convex Rakers 8+13, lanceolate. Scales 56 + 3, 8 above, 16 below, 46 predorsal, 8 rows on cheek to preopercle ridge and few irregular on preopercle flange, 11 to 13 basal striae and 3 auxiliaries, 110 to 125 apical points with biserial segments D. XII, 10, I, fourth spine 2⅛ in head, sixth ray 3, A III, 8, I, second and third, spines subequal or 3⅞, last ray 3, caudal 1⅛, widely emarginate, caudal peduncle depth 2⅞, ventral 1¾, pectoral 2⅝ in combined head and body Pale brown, more so below, largely tinged pink Fins pale Length 355 mm

Cape Peninsula waters, in 100 fathoms

In many ways a younger stage of *Dentex rupestris* Smith, whose figure shows about 20 rows of cheek scales to the preopercular edge, longer third anal spine and shorter pectoral No mention is made in his text of the lower gash on the preopercle as shown in his figure

Castlenau placed Smith's *Dentex rupestris* with *Chrysophrys laticeps* Valenciennes This is unlikely true Günther described several specimens of *C laticeps* in the British Museum as "in both jaws one series of large molars only; interiorly with a band of granular molar teeth irregularly arranged" It is clear his example belongs to *Sparus* and not to *Dentex* For *Dentex rupestris* Günther gives "seventeen rows of scales between the preorbital and the margin of the preoperculum, which is also covered with scales for its greater part" As his specimen was an adult stuffed and dried, likely he could not examine the hind or lateral teeth

Dentex natalensis Gilchrist and Thompson

Depth 2½, head 3⅞, width 2⅒, snout 2¾, eye 3⅜, 1½ in snout, 1¼ in interorbital, maxillary 2⅞ in head, ⅞ in snout, expansion 2 in eye, canines ⅜, row of outer larger teeth, posterior submolariform and anteriorly inner band of small pointed teeth, interorbital 3 in head, convex Rakers 8 + 13, lanceolate Scales 51 + 2, 8 above, 16 below, 62 predorsal to front nostril, 8 rows across cheek to preopercle ridge and flange scaly, 9 basal striae, 96 to 147 apical points with 18 to 22 rows of basal segments D. XII, 10, I, fourth spine 1⅔ in head, third ray 2½, A III, 7, I, second spine 2½, second ray 2⅜, ventral 1⅓, caudal deeply emarginate, 2⅞ in combined head and body, pectoral 3⅛ Brown above, below paler. Along back and upper side each row of scales with dark median narrow band Vertical fins and ventral dusky, pectoral pale Length 340 mm

Delagoa Bay

Dentex miles Gilchrist and Thompson

Depth 2½, head 3, width 2¼, snout 2⅓, eye 4, 1⅗ in snout, 1⅛ in interorbital; maxillary 2½ in head, to eye, expansion 1⅘ in eye, canines ¼, outer row of conic teeth and inner band of small granular teeth, interorbital 3⅜, convex. Rakers 6 + 13, lanceolate Scales 61 + 8, 8 above, 15 below, 42 predorsal to front eye edge, 8 rows on cheek to preopercle ridge and flange naked, 8 to 10 basal striae, apical points 107 to 126 with 18 to 20 rows of basal segments D XII, 10, I, third spine 1⅓ in head, last ray 2¾, A III, 8, I, third spine 3⅕, third ray 3, caudal 1⅕, deeply emarginate, ventral 1⅓, pectoral 2⅕ in combined head and body. Back pale olive, below whitish Traces of longitudinal darker line along each row of scales medianly Length 290 mm

Natal coast, in 20 to 30 fathoms

Lethrinus scoparius Gilchrist and Thompson

Depth 2⅗ to 2⅔, head 2⅗ to 2⅞, width 2⅒ to 2¼, snout 2 to 2¼, eye 3 to 3⅒, 1⅓ to 2⅕ in snout, 1 to 1⅕ in interorbital, maxillary 2¾ in head, to front nostril, to hind nostril with age, expansion 2 in eye, outer enlarged row of teeth and band of 4 or 5 rows of fine teeth, and hind 4 to 6 outer teeth in each jaw molar, canines ⅔, interorbital 3⅒ to 3¾ in head, broadly convex Rakers 6 + 5 short stumps Scales 45 to 48 + 1, 5 above, 15 or 16 below, 9 or 10 predorsal, 16 to 19 basal striae, 103 to 107 apical points with 11 or 12 rows of basal segments D X, 9, I, fourth spine 2⅞ to 3 in head, fourth ray 2¼ to 2⅗, A. III, 8, I, third spine 2⅘ to 3¼, first ray 2⅗ to 2⅔, caudal 1⅕ to 1¼, deeply emarginate, pectoral 1⅕ to 1⅙, ventral 1⅓ to 1⅗, caudal peduncle depth 3 to 3⅕ Dull purplish brown above, whitish below Several darker broken streaks along snout longitudinally, and 1 along lower eye edge Iris brown. Trunk with obscure darker markings Pectoral pale or whitish Ventral neutral dusky terminally Length 127 to 213 mm

Delagoa Bay, three specimens

Lethrinus genivittatus Valenciennes

Depth 3, head 2¾, width 2⅕, snout 2⅗, eye 3, 1⅕ in snout, equals interorbital, maxillary 2¾ in head, to eye, expansion 2⅗ in eye, teeth uniserial, posterior conic, canines ⅘, interorbital 3⅓ in head, level Rakers 5 + 8, low tubercles Scales 41, 4 above, 14 below, 8 predorsal, 10 to 12 basal striae, 43 to 50 apical points and 1 or 2 rows of basal segments D X, 9, I, fourth spine 2⅙ in head, first ray 2⅔, A III, 8, I, third spine 3⅓, first ray 2⅘, caudal 1⅗, deeply emarginate, caudal peduncle depth 3⅙, pectoral 1⅓, ventral 1¾ Brown above, pale or warm brownish below Side with 7 faint darker irregular cross bands Dark streak below eye down to preopercle ridge. Fins pale brown. Length 95 mm

Delagoa Bay

Originally described from material obtained by Peron, doubtless from the East Indies or Mauritius The description by Valenciennes, imperfect from modern standards, applies to the adult, likewise his figure My example has the very characteristic dark vertical bands on the side of the head, the first from lower front eye edge to maxillary end, second from median lower eye edge and third on postocular down over preopercular flange. Traces of dusky spots, so clearly shown on the figure on the dorsals, anals and ventrals, are very evident The dark cross bands of my example, a condition of youth, suggest *Lethrinus moensi* Bleeker. The above record is of interest as it establishes another long lost species in the fauna of southeast Africa

Lethrinus acutus Klunzinger

Depth 3⅜, head 2¾, snout 2½, eye 3⅜, maxillary 2⅞, to hind nostril, teeth in narrow bands, with outer row of variously enlarged canines or 4 or 5 in front of each jaw, interorbital 3⅜, broadly convex Rakers 4 + 7 low tubercles Scales 47 + 4, 6 above, 15 below, 8 predorsal, 12 to 14 basal striae, 51 to 53 apical points with 2 or 3 rows of basal segments D X, 9, I, fourth spine 2⅓ in head, fourth ray 2¾, A III, 8, I, third spine 3⅓, first ray 2⅝, caudal 1⅝, emarginate, caudal peduncle depth 3⅓, pectoral 1⅜; ventral 1⅓. Back gray brown, each row of scales longitudinally with antique brown band, formed as spot on each scale Vertically 7 or more irregular and more or less inclined obscure dark gray brown streaks Under surface of head and body whitish. Iris pale slate Fins pale gray, spinous dorsal terminally little more dusky. Ventral pale, with 3 dusky gray blotches Inside gill opening pale Length 118 mm

Delagoa Bay

Lethrinus mahsenoides Valenciennes

Depth 2¼, head 2¾, snout 2⅓, eye 3, maxillary 3, to front nostril, row of strong, conic, teeth in jaws, posteriorly short but not molar, canines 4/4 and pair each side of mandible medially, each jaw anteriorly with narrow band of fine teeth, interorbital 4, level. Rakers 4 + 5, low tubercles. Scales 47 + 3, 6 above, 16 below, 10 predorsal, 12 to 15 basal striae, 52 to 71 apical points and 4 or 5 rows of basal segments. D X, 9, I, fifth spine 2⅝ in head, fourth ray 2¼, A. III, 8, I, second spine 2⅞, fourth ray 2½, caudal 1¼, deeply emarginate, caudal peduncle depth 3, pectoral 1⅓; ventral 1⅞ "Pale blue and gray edging to scales Caudal yellow Other fins pale gray, darker on anal" Ventral with 2 broad, obscure, dusky gray blotches Length 105 mm.

Delagoa Bay

GIRELLIDAE

Tripterodon orbis Playfair

Depth 1⅓, head 3¼, width 2, snout 1¾, eye 3⅜, 2 in snout, 1¼ in interorbital, maxillary 3⅜ in head, to hind nostril, expansion 2 in eye, teeth tridentate incisors, 4 rows in each jaw, interorbital 2⅞ in head, convex, slightly gibbous Rakers 1 + 10 short points. Scales 45, 7 above, 21 below; soft vertical fins densely scaled; 4 basal striae, 57 to 65 apical points with 13 to 18 rows of basal segments D IX, 20, I, third spine 2⅓ in combined head and body, fourth ray 1¼ in head, A III, 16, I, second spine 3½, third ray 1¼, caudal 1, emarginate, caudal peduncle depth 2⅗, pectoral 1¾, ventral 2⅞ in combined head and body Pale brown above, whitish beneath, each row of scales with longitudinal silvery white band Obsolete, dusky, transverse band from eye across cheek Body with 5 broad transverse dusky bands, alternate incomplete bar or band in each interspace Length 230 mm.

Delagoa Bay

Crenidens crenidens (Forskål)

Depth 2½, head 3⅗, width 2, snout 2⅞ in head, eye 3¼, 1¼ in snout, 1⅕ in interorbital, maxillary 3½ in head, to eye, expansion 3, outer row of 16 quindentate incisors, with close set inner row of similar teeth and biserial molars, interorbital 3$\frac{1}{10}$, widely convex Rakers 7 + 10 lanceolate Scales 54 + 5, 5 above, 13 below, 16 predorsal to occiput, 3 rows on cheek to preopercle ridge, and flange naked, 7 to 9 basal striae, 16 to 68 apical points with 11 to 16 rows of segments D XI, 11, I, fourth spine 1⅞ in head, first ray 2⅕, A III, 10, I, second spine 2⅕, first ray 2¼, caudal 1, deeply emarginate, caudal peduncle depth 2⅗, ventral 1¼, pectoral 2⅞ in combined head and body Olive above, below whitish, each row of scales with narrow dusky median line Dorsals and caudal grayish, ventral dusky terminally, lower fins white Length 154 mm.

Delagoa Bay

Sarpa salpa (Linné)

Depth 3, head 3¾, width 1⅘, snout 3$\frac{1}{10}$, eye 3⅗, 1⅕ in snout, 1¼ in interorbital, maxillary 3¾ in head, ¾ to eye, teeth compressed, notched, interorbital 2⅞, convex Rakers 6 + 14, lanceolate Scales 71 + 10, 6 above, 14 below, 26 predorsal to occiput, 6 rows on cheek to preopercle ridge, 9 or 10 basal striae, 68 to 70 apical points with 8 or 9 rows of transverse segments D XI, 16, I, fifth spine 2 in head, first ray 3, A III, 13, second spine 3⅕, first ray 2¾, caudal 1, well forked, pectoral 1¼, ventral 1⅓ Back grayish, with 7 pale longitudinal lines, below pale buff to whitish Iris silvery white Dorsals and caudal grayish, other fins whitish Pectoral with black blotch at origin Length 150 mm

Natal

HISTIOPTERIDAE

Histiopterus spinifer Gilchrist

Depth 1⅗, head 2⅝, width 2⅕, snout 2¼, from snout tip, upper profile deeply concave, eye 1⅗ in snout, maxillary 3¼ in head, ⅗ in snout, expansion 2¾ in eye, radiating striae above eye and on opercle Rakers 5 + 15, lanceolate Scales 54 + 11 + 4, 15 above, 20 between lateral line angle and spinous anal origin, 8 or 9 basal striae, 18 or 19 apical points with 4 transverse rows of basal segments and circuli coarse D III, 27 anterior all elongate with fleshy tips, longest 1⅗ in combined head and body, A III, 9, second spine 1⅗ in total head length, third ray 1⅗, pectoral 1¼, ventral

$1\frac{3}{10}$ in combined head and body Heliotrope purple, with dusky neutral tinge Branchiostegals and under surface of head dusky Dorsals, anals and ventrals largely blackish neutral, spines pale, also pectoral and caudal Length 90 ? mm

Natal, in 35 fathoms

GERRIDAE

Gerres longirostris Günther

Depth $2\frac{1}{4}$, head $3\frac{1}{3}$, width 2, snout $3\frac{3}{5}$, eye $3\frac{3}{5}$, $1\frac{1}{3}$ in interorbital, maxillary 3 in head, to eye, expansion 3 in eye, interorbital $2\frac{3}{5}$ in head, convex, groove broadly scaleless Rakers 6 + 7, lanceolate, short Scales 45 + 3, 6 above, 12 below, 25 predorsal, 5 basal striae D IX, 11, I, first ray $2\frac{1}{2}$ in head, A III, 7, I, third spine $2\frac{3}{5}$, first ray $2\frac{4}{5}$, caudal 1, forked, ventral $1\frac{1}{8}$, pectoral $2\frac{3}{4}$ in combined head and body Back pale olive brown, sides, below, and iris silvery white Back and side above with 8 rows of scales, each with dark longitudinal line. Dorsals and caudal grayish, other fins whitish. Length 195 mm

Natal

Agrees with Günther's figure,[10] except he shows the breast scales much smaller

Gerres filamentosus Cuvier

Depth $2\frac{1}{3}$, head 3, width 2, snout $3\frac{1}{8}$, eye $3\frac{1}{8}$, $1\frac{1}{4}$ in interorbital, maxillary 3 in head, to eye, expansion 3 in eye, well exposed, interorbital $2\frac{1}{2}$, convex, groove scaleless Rakers 5 + 7, short, lanceolate Scales 44 + 5, 5 above, 10 below, 20 predorsal, 3 rows on cheek to preopercle ridge, 6 basal striae. D IX, 10, I, second spine prolonged filament reaching beyond middle of depressed dorsals, first ray $2\frac{3}{5}$ in head, A III, 7, I, third spine $2\frac{1}{3}$, first ray $2\frac{3}{5}$, caudal 1, forked, pectoral $2\frac{3}{5}$ in combined head and body, ventral $1\frac{3}{5}$ in head. Back dull brown, below silvery white Dorsals and caudal tinged gray, other fins white Length 165 mm.

Delagoa Bay

Gerres oblongus Cuvier

Depth $3\frac{1}{4}$, head $3\frac{3}{5}$, snout $3\frac{1}{3}$, eye $3\frac{1}{3}$, maxillary to eye, not to pupil, expansion 3 in eye, interorbital $2\frac{1}{5}$ in head, broadly convex, scaleless forward in groove. Rakers 4 + 8, lanceolate Scales 43 ?, 5 above, 10 ? below, 20 ? predorsal D IX, 10, I, second spine $1\frac{1}{3}$ in head, first ray $2\frac{3}{5}$, A. III, 6, I, second spine 3, second ray $2\frac{1}{5}$; caudal peduncle depth $3\frac{1}{4}$, pectoral $1\frac{1}{10}$, ventral $1\frac{3}{5}$, caudal forked, little longer than head "Silvery, back darker. Scales and dorsal have fine black border. Eye silvery" Small, pale dusky spot on each membrane of dorsal before spine and rays just above line of basal sheath of scales. Length 110 mm

Delagoa Bay

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[10] Proc Zool Soc London, 1861, p. 142, Pl 24

Gerres acinaces Bleeker

Depth 2¾, head 3¼ to 3⅓, width 2 to 2⅒, snout 3, eye 3, 1⅕ to 1⅓ in interorbital, maxillary 2⅗ in head, to eye, well exposed, interorbital 3, convex, groove scaleless Rakers 6 + 7, short Scales 43 + 5, 7 above, 10 below, 24 predorsal, 3 rows on cheek to preopercle ridge D IX, 10, i, second spine 1⅞ in head, first ray, 2¾, A. III, 7, i, second spine 2⅗ to 3¼, first ray 2⅔ to 2½, caudal 1, widely forked, caudal peduncle depth 2⅘, ventral 1⅞ to 1⅗, pectoral 3 in combined head and body Dull brown above, below silvery white Back with each scale with dusky spot forming longitudinal dark lines Transversely 10 to 12 dusky bars cross longitudinal streaks Snout brown above, sides and mandible whitish Dorsals dusky gray terminally, whitish basally Caudal grayish marginally, whitish basally, other fins and iris whitish Length 135 to 157 mm

One from Durban Bay, and Delagoa Bay, one.

MULLIDAE

Upeneus dispilurus Playfair

Depth 3⅓, head 3, snout 2⅕, eye 4, maxillary 2¾, ⅘ to eye, expansion 1⅗ in eye, teeth uniserial, strong, conic, upper little larger, barbels 1¼ in head, interorbital 4, broadly convex. Rakers 6 + 21, lanceolate Scales 28 + 2, 3 above, 6 below, 13 predorsal, 4 rows on cheek to preopercle edge, 5 or 6 basal striae, 70 to 96 apical points D VIII—I, 8, i, third spine 1⅗ in head, first ray 2⅔, A II, 6, i, second spine 3⅘, first ray 2¾, caudal 1¼, forked, caudal peduncle depth 3, pectoral 1⅓, ventral 1⅗ "Gamboge, mixed with clouded red, soon fading after death " Length 120 mm.

Delagoa Bay

No dark saddle on caudal peduncle above Playfair's figures show a much shorter maxillary and though he says "the anterior margin of the eye occupying the middle of the head" his figure shows it advanced He also says the "height of the spinous dorsal is nearly half that of the body," while both his figures show it more He confuses his account with the nominal *Mullus pluro-taenia* according to Day, who contends this is properly the young, and that the figures were transposed Klunzinger needlessly names, describes, and figures the species as new, calling it *Parupeneus notospilus* [11]

Upeneus pleurostigma Bennett

Depth 3⅓, head 3⅓, width 2¼, snout 2⅓, eye 4, 1¾ in snout, 1¼ in interorbital, maxillary ¾ to eye, expansion 1⅓ in eye, teeth uniserial, conic, barbel 1¼ in head, interorbital 3⅓, broadly convex. Rakers 5 + 18, lanceolate Scales 27 + 2, 2 above, 6 below, 13 predorsal,

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[11] Fische Rothen Meeres, 1888, p 51, Pl. 5, fig 3 Koseir Harbor

3 rows on cheek to preopercle edge, 5 or 6 basal striae, 85 to 88 apical points with 6 rows of basal segments. D. VIII—I, 8, second spine 1⅗, first ray 2⅒ in head, A. I, 6, first ray 2¼, caudal 1⅗, forked, caudal peduncle depth 2⅗; pectoral 1¼; ventral 1⅗. Dull brown, paler below Round dusky spot size of pupil at eighth or ninth scale of lateral line Dorsal with dusky gray terminally, anal whitish Length 120 mm

Delagoa Bay.

Upeneus fraterculus Valenciennes

Depth 3⅓ to 3⅗, head 3⅓ to 3⅓, width 1⅗ to 1⅗, snout 2¼ to 2⅓, eye 4 to 4⅓, 1⅖ to 2 in snout, 1⅓ to 1¼ in interorbital, maxillary 2⅗ to 3 in head, ⅗ to ¾ to eye, expansion 1⅓ to 1⅗ in eye, teeth uniserial, short conic, barbel 1⅓ in head; interorbital 3 to 4, convex. Rakers 6 + 18, lanceolate Scales 27 or 28 + 2, 3 above, 6 below, 10 to 13 predorsal, 3 rows on cheek to preopercle edge; 6 basal striae, 108 to 110 apical points and 8 rows of basal segments D VIII—I, 8, i, second spine 1⅓ to 1⅗ in head, first ray 2 to 2⅓, A II, 6, i, first ray 2 to 2⅓, caudal 1⅒ to 1⅓, forked, pectoral 1⅓ to 1⅗, ventral 1⅓ to 1¼ Dull brown, below whitish Dusky black saddle on caudal peduncle above and equally broad one in front Spinous dorsal dusky terminally Soft dorsal with 4 horizontal dusky streaks, anal with 3 paler and each caudal lobe with 4 pale dusky cross bars Length 140 to 150 mm

Two from Delagoa Bay

Upeneoides vittatus (Forskål)

Depth 3¼, head 3½, width 2, snout 2⅗, eye 3⅓, 1¼ in snout, 1⅓ in interorbital, maxillary 2⅓ in head, to ⅓ in eye, expansion 1½ in eye, teeth irregularly triserial, short, small, simple, conic, band of fine vomerine and palatine teeth, barbel 1⅓ in head, interorbital 3⅓, slightly concave. Rakers 8 + 20, lanceolate Scales 36 + 3, 3 above, 6 below, 14 predorsal, 3 ? rows on cheek; 5 basal striae, 67 or 68 apical points with 4 or 5 rows of basal segments D VIII—I, 8, i, second spine 1⅓ in head, first ray 1¾, A. I, 6, i, first ray 1¾, caudal 1, forked, caudal peduncle depth 2½, pectoral 1⅓, ventral 1⅓ Brown, whitish below Above lateral line 2 longitudinal deeper brown streaks and another below Spinous dorsal pale, tip black and 2 horizontal dusky bands, soft dorsal similar only tip darker. Caudal gray, with 4 dark cross bars on upper and 3 on lower lobe. Length 120 mm

Delagoa Bay.

SCIAENIDAE

Otolithus ruber (Schneider)

Depth 3¾ to 4¼, head 3⅓ to 3⅓, width 2⅓ to 2⅓, snout 3⅗ to 4, from snout tip, eye 6 to 6⅔, 1⅔ in snout, 1⅓ in interorbital; maxillary 2¾ to 2⅓ in head, to eye center, expansion 1½ in eye, canines ⅘, teeth conic, uniserial, above 2 or 3 irregular rows villiform inside, interorbital 4⅓ to 4½, broadly convex Rakers 6 + 15, lanceolate Scales 47 to 50 + 27 to 40, 7 or 8 above, 7 to 9 below, 33 to 40 predorsal, 15 basal striae, 20 to 26 apical points with 15 or 16 rows of basal segments. D IX—I, 27, I or 28, I, third spine 2⅓ to 3¼ in total head length, first ray 3 to 3⅓, A II, 7, I, second spine 5 to 5⅓, second ray 2⅗ to 2¾, caudal 1⅓ to 1⅗, rounded behind, median upper rays longest, caudal peduncle depth 3⅗, pectoral 1⅖ to 1⅗, ventral 2 to 2⅕ Brown above, sides lilac, below silvery white Iris whitish, neutral above and below Dorsals and caudal brown, former dusky terminally, other fins pale Length 230 to 337 mm

One from Natal, Tugela River in 60 fathoms, and Delagoa Bay

Johnius sina (Cuvier)

Depth 3, head 3⅓, snout 3⅔, eye 4½, maxillary 2⅓, nearly to hind eye edge, expansion 1⅗ in eye, teeth fine, in bands in jaws, outer row enlarged above and inner below, several outer teeth, as slight canines anteriorly above, 6 mandibular pits, interorbital 3⅓, broadly convex Rakers 8 + 18, lanceolate Scales 47 + 6, 6 above, 7 below, 9 rows on cheek, anal entirely scaled, 14 to 16 basal striae, 42 to 46 apical points with some minutely bifid and basal segments in 4 or 5 rows D X, I, 27, I, second spine 2⅗ in head, first ray 3, A II, 7, I, second spine 3⅓, second ray 2, caudal 1⅓, hind edge slightly obliquely double convex; caudal peduncle depth 3, pectoral 1⅓, ventral 1⅗ "Back mauve silvery Dorsal rays dark gray, soft rays whitish Caudal gray, also pectoral. Ventral paler Anal pale Eye silvery gray over top" Length 168 mm

Delagoa Bay

Johnius parvus (Gilchrist and Thompson)

Depth 2⅗ to 3, head 3⅒ to 3⅖, width 1⅞ to 2, snout 3 to 3¾, eye 4⅓ to 5⅖, 1 to 1¾ in snout, 1¼ to 1¾ in interorbital, maxillary 2⅓ to 2⅗ in head, to eye center or hind pupil edge, expansion 1⅓ to 2 in eye; teeth in 3 to 5 irregular series of small ones, outer row large and well separated, interorbital 3 to 3½ in head, broadly convex Rakers 7 or 8 + 16, lanceolate Scales 42 to 45 + 6 to 10, 5 or 6 above, 6 to 9 below, 26 to 30 predorsal, 16 to 18 basal striae, 61 to 78 apical points with 17 to 20 rows of basal segments D X—I, 26, I or 27, I, third spine 1⅞ to 2¼ in head, first ray 3 to 3⅓, A II, 7, I, second spine 2½ to 3⅖, second ray 2, caudal 1⅙ to 1⅓, lower median rays longest, more pointed in younger, caudal peduncle depth 3⅒ to 3⅙; pectoral 1¼ to 1⅓, ventral 1¼ to 1¾. Pale purplish gray above, below whitish Opercle with or without dusky Fins dusky gray terminally, spinous dorsal neutral black. Length 102 to 235 mm.

Two from Delagoa Bay and one from Natal

Johnius marleyi Norman.

Depth 3½, head 3¼, width 3, snout 4, eye 5, 1¼ in snout, 1 in interorbital, maxillary 2⅘ in head, to hind pupil edge, expansion 1⅗ in eye, 4 mandibular pores Rakers 6 + 12, lanceolate Scales 81 + —, tubes 49 + 13, 10 scales above, 10 below, 22 predorsal to occiput, 8 to 10 basal striae, 30 to 38 apical points with 6 or 7 rows of basal segments D. X—I, 27, i, third spine 2½ in head, fourth ray 2⅓, A II, 7, i, second spine 3⅓, first ray 1 7/10, caudal 1½, pectoral 1¾, ventral 1½ Brownish, whitish below Opercle with neutral tint Spinous dorsal dusky, soft dorsal, caudal and anal dark gray Small blackish spot superiorly in pectoral axil Paired fins pale brown. Length 169 mm.

Natal

Sciaena striata (Boulenger)

Depth 2⅞, head 3⅛, width 2 1/10, snout 3¼, eye 4⅛, 1¼ in snout, 1⅜ in interorbital, maxillary 2⅝ in head, to front pupil edge, expansion 2¾ in eye, symphyseal barb ½ of pupil, 2 pores each side and snout end with 6, of which 3 lower largest, interorbital 4, convex. Rakers 5 + 11, short points Scales 47 + 17, 8 above, 11 below, 42 predorsal, 14 or 15 basal striae, 73 to 96 apical points and 4 or 5 rows of basal segments D X—I, 28, i, fourth spine 2⅛ in head, eighth ray 3, A II, 7, i, second spine 3⅛, second ray 2⅜, caudal 1⅞, pectoral 1½; ventral 1⅞ Brown, little paler below Back and upper side with 9 broad, neutral, dusky, oblique bands, counted vertically, all crossing lateral line and posterior border Fins brown, front of anal and ventral dusky terminally. Length 332 mm

Natal coast south, in 20 fathoms

It agrees with Boulenger's description,[12] except he gives head 2⅜ in total His example was dried and measured 402 mm. Later Gilchrist and Thompson[13] also described it under the same name as new, on an example 267 mm.

SILLAGINIDAE

Sillago sihama (Forskål)

Depth 5⅜, head 3½, width 2¼, snout 2⅝, eye 5, 1⅝ in snout, 1¼ in interorbital, maxillary 4 in head, ⅞ to eye, interorbital 3⅞ in head, broadly convex Rakers 7 + 11, lanceolate. Scales 60, 6 above, 8 below, 22 predorsal D XI, i, 21, i, second spine 1⅞ in head, first ray 2⅜, A i, 24, second branched ray 3⅛, caudal 1⅓, forked, caudal peduncle depth 3⅞, pectoral 1⅝, ventral 1⅞. Back pale brown, with scattered, darker brown markings, below silvery white. Median lateral series of small brown spots. Dorsals and caudal grayish, other fins pale. Length 135 mm.

Durban beach.

Sillago maculata Quoy and Gaimard.

Depth 5⅜ to 5¾, head 3⅛ to 3⅜, width 2¼ to 2⅜, snout 2⅜ to 2½; eye 3⅝ to 4, 1½ to 1¾ in snout, maxillary 4⅛ to 4⅜ in head, 1¾ to 2 to eye;

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[12] Proc Zool Soc London, 1887, p 660 Muscat.

[13] Ann S Af Mus, 6, 1908, p 181.

interorbital 5 to 5⅓ in head, nearly level Rakers 3 + 10, lanceolate Scales 63 to 65 + 7, 6 above, 9 or 10 below, 28 to 31 predorsal, 6 to 9 basal striae, 38 to 42 apical points with 1 to 6 rows of basal segments D X, I, 21, I or 22, I, second spine 1⅞ in head, second branched ray 2⅓, A I, 23, I, second branched ray 3¼ to 3⅓, caudal 1⅗ to 1¾, slightly emarginate, truncate expanded, caudal peduncle depth 4 to 4⅓, pectoral 2, ventral 2 to 2⅒ Back pale brown, scale edges slightly darker, below white Traces of silvery, median, longitudinal band Dorsals and caudal brownish, other fins paler First dorsal with blackish dots on membranes superiorly Length 110 to 137 mm

Delagoa Bay

BRANCHIOSTEGIDAE

Branchiostegus japonicus (Houttuyn)

Depth 3⅗ to 3⅞, head 3⅓ to 3⅗, width 2⅓, snout 2½, eye 4¾ to 5⅛, 2⅓ in snout, 1⅗ in interorbital, maxillary 2⅓ to 2⅗, to eye, expansion 2⅓ in eye, interorbital 3½, convex, preopercle edge finely serrate Rakers 7 + 13, lanceolate Scales 61 to 63 + 8 to 12, tubes 44 to 54 + 4 or 5, 7 or 8 above, 14 to 18 below, 22 to 27 predorsal, 11 to 16 marginal striae, submarginals 8 to 30, apical points 30 to 72 with 3 or 4 rows of basal elements D VII, 15, I, third spine 3 to 3⅗ in head, thirteenth ray 1½ to 1¾, A II, 12, I, eleventh ray 1⅘ to 2, caudal 1¼, slightly convex behind, pectoral 1⅗, ventral 2 "Body banded (20 to 22) with violet, white and yellow Head violet rosy, with blue spots on cheek Eye pale olive and white Dorsal rays red, anal yellow Caudal yellow at base and deep rosy spot, rays yellow, pink and mauve Ventral pale blue." Length 300 to 440 mm

Natal coast, in 20 fathoms, Tuguela River, in 60 fathoms

CIRRHITIDAE

Cheilodactylus fasciatus Lacépède.

Depth 2⅘, head 2⅞, width 2, snout 2⅞, eye 3¾, 1¼ in snout, maxillary 4⅓ in head, to hind nostril, interorbital 4 in head, slightly convex to level Rakers 5 + 13, lanceolate Scales 76 + 6, 8 above, 17 below, 52 predorsal, 18 rows across cheek to preopercle angle, 10 basal striae with 3 auxiliaries, 7 to 9 broad flat terminal denticles, median often bifid. D XVIII, 23, I, fourth spine 3⅓ in head, last spine 3½, first ray 2⅘, A III, 10, I, second spine 3¾, second ray 2, caudal 1⅓, forked, caudal peduncle depth 4¼, P 8, v, third branched ray 1⅘, second simple ray 1 Dull brown, whitish below Six dusky transverse bands, much narrower than interspaces and inclined slightly posteriorly below. Iris slate Fins all pale brown. Length 135 mm

Removed from stomach of steinbrass, taken on the Natal coast, at 8 fathoms.

ANTIGONIDAE

Antigonia capros Lowe

Depth $1\frac{1}{10}$, head 3, width 2, snout 3, eye 3, maxillary $4\frac{1}{3}$, interorbital 5. Rakers 5 + 10, short points Scales 52 + 3, 10 above, 42 below from arch of lateral line, 5 rows on cheek to preopercle ridge, 3 or 4 indistinct basal striae, 29 or 30 apical points and 7 large subapical denticles D IX, 29, third spine equals head, third ray 3, A III, 26, first spine $2\frac{3}{5}$, third ray $2\frac{7}{8}$, caudal $1\frac{1}{3}$, obliquely emarginate behind, upper rays longer, slightly convex when expanded, pectoral $1\frac{1}{6}$, ventral $1\frac{1}{5}$ Pale brown, with traces of rosy tints Length 107 mm

Natal coast, in 40 fathoms

Compared with Goode and Bean's figure[14] my example has more robust fin spines, besides showing a large area of radiating striae above the eye This is well shown in Müller and Troschel's figure of *Caprophonus aurora.* Likely *Antigonia mülleri* Klunzinger is the young, and, as its radial formula agrees more nearly with my example, the increase as given by Lowe, and Müller and Troschel, pertain to the adult The East Atlantic, Indian Ocean and New Zealand forms are evidently the same Quite likely *Antigonia eos* Gilbert is the young of *Antigonia steindachneri*, likewise *Hypsinotus rubescens* Schlegel, which was founded on a small example, and *Antigonia fowleri* Franz are still other synonyms

EPHIPPIDAE

Ephippus tetracanthus (Lacépède)

Depth $1\frac{1}{3}$ to $1\frac{3}{5}$, head 3 to $3\frac{1}{3}$, width $1\frac{3}{4}$ to $1\frac{4}{5}$, snout 3 to $3\frac{1}{5}$, eye $3\frac{1}{3}$ to 4, 1 to $1\frac{1}{5}$ in snout, $1\frac{2}{5}$ to $1\frac{4}{5}$ in interorbital, maxillary $4\frac{1}{3}$ to $4\frac{3}{4}$ in head, largely concealed, to hind nostril, interorbital $2\frac{1}{3}$ to $2\frac{3}{4}$, broadly and rather evenly convex. Rakers 3 + 5 short points Scales 92 to 96 + 8, 17 above, 40 below, single basal stria and 34 to 40 uniserial uniform apical points D XI, 17 or 18, third spine $1\frac{1}{5}$ to $1\frac{1}{3}$ in head, third ray $1\frac{1}{10}$ to $1\frac{1}{3}$, A IV, 13 to 15, second spine $2\frac{1}{4}$ to $2\frac{1}{3}$, third ray $1\frac{1}{5}$ to $1\frac{1}{3}$, caudal $1\frac{1}{5}$ to $1\frac{1}{5}$, truncate, caudal peduncle $2\frac{1}{10}$ to $2\frac{1}{5}$, pectoral $1\frac{1}{3}$ to $1\frac{3}{5}$, ventral 1 Back pale gray, whitish below Six dark purple-gray vertical bands, first through eye, second from predorsal across opercle, third from front of spinous dorsal, fourth from hind part of spinous dorsal, fifth from soft dorsal, sixth on caudal peduncle above Iris brown Spinous dorsal dusky, blackish terminally, outer vertical fins dusky brown Paired fins paler. Length 115 to 165 mm.

Two from Delagoa Bay.

Lacépède's figure is based on Cummerson's drawing, likely from a

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[14] Oceanic Ichth., 1895, Pl 65, fig. 225

Mauritius specimen It is quite crude, though shows very distinct dark vertical bands and without one through the eye. My specimens represent an interesting rediscovery of the species and establish its locality definitely

DREPANIDAE

Drepane punctata (Linné)

Depth 1 to $1\frac{1}{10}$, head $2\frac{2}{3}$ to 3, width 2 to $2\frac{1}{10}$, snout 2 to $2\frac{1}{4}$, eye 3 to $3\frac{3}{4}$, $1\frac{1}{4}$ to $1\frac{7}{8}$ in snout, $1\frac{1}{8}$ in interorbital, maxillary $3\frac{1}{10}$ to $3\frac{2}{5}$ in head, to front nostril, expansion $2\frac{1}{2}$ to 3 in eye, interorbital $3\frac{1}{3}$ to $4\frac{1}{3}$, slightly convex Rakers 6 or 7 + 11 or 12, short, weak points Scales 53 + 5, tubes 42 to 45 +, 13 to 16 scales above, 28 to 30 below, 49 predorsal, 8 rows on cheek to preopercle ridge, 3 to 6 basal striae D IX, 21 or 22, fourth spine $1\frac{2}{3}$ to $1\frac{3}{4}$ in head, eighth ray $1\frac{1}{3}$, A III, 17 to 19, second spine $2\frac{1}{2}$ to $3\frac{1}{2}$, third ray $1\frac{2}{3}$, caudal $1\frac{1}{10}$ to $1\frac{1}{5}$, convex behind or with median broad angle, caudal peduncle depth $2\frac{3}{4}$, ventral $1\frac{1}{10}$, pectoral $1\frac{3}{5}$ to $1\frac{3}{4}$ in combined head and body Grayish above, white below, with silvery reflections Six transverse dark brown lateral bands alternating with slightly narrower ones Iris silvery white Fins pale Length 90 to 190 mm

Two from Delagoa Bay, and one from Natal

CHAETODONTIDAE

Chaetodon lunula (Lacépède)

Depth $1\frac{1}{3}$, head 3, width 2, snout 3, eye $1\frac{1}{4}$, $1\frac{1}{5}$ in snout, $1\frac{1}{3}$ in interorbital, maxillary $3\frac{4}{5}$ in head, $\frac{3}{5}$ in snout, interorbital $3\frac{1}{3}$ in head, broadly convex Rakers 16 + 12, short Tubes 35 in lateral line, scales 44 + in median lateral series, 10 above, 16 below, 40 predorsal, 7 or 8 basal striae, 100 to 111 apical points with 14 to 20 rows of basal segments D XII, 25, i, sixth spine $1\frac{4}{5}$ in head, first ray 2, A III, 19, i, second spine $1\frac{9}{10}$, first ray $1\frac{2}{3}$, caudal $1\frac{3}{5}$, little convex behind, pectoral $1\frac{1}{4}$, ventral $1\frac{1}{3}$ Olive brown on back, yellowish olive below Broad black band across interorbital and over cheek to lower preorbital edge Another along bases of first 5 dorsal spines and predorsal, edged broadly yellow below From sixth and seventh dorsal spines, basally, black band obliquely forward, broadening above pectoral base to include area just behind gill opening, broadly edged yellowish Black blotch on caudal peduncle above Outer dorsal and anal edges broadly blackish Soft dorsal with dusky subbasal band, also forward on spinous fin Hind caudal edge broadly white, with outer submarginal blackish band and inner gray band, fin pale basally Paired fins gray Length 154 mm

Natal.

Chaetodon marleyi Regan

Depth $1\frac{1}{3}$, head $2\frac{4}{5}$, width $2\frac{1}{10}$, snout $3\frac{1}{3}$, eye $2\frac{3}{4}$, maxillary $3\frac{1}{2}$, to hind nostril, interorbital $3\frac{1}{4}$, broadly convex, preopercle edge entire

Rakers 5 + 10, lanceolate Tubes 37 in lateral line, scales 43 + 5 in median lateral series, 6 above, 22 below, 40 predorsal, 6 rows on cheek to preopercle ridge and 3 more across flange, 14 basal striae, 65 to 80 apical points with 1 or 2 rows of basal segments D X, 24, I, fifth spine $1\frac{4}{5}$ in head, second ray $1\frac{3}{4}$, A III, 18, I, third spine 2, second ray $1\frac{3}{4}$, caudal $1\frac{1}{3}$, truncate, caudal peduncle depth $2\frac{4}{5}$, pectoral $1\frac{1}{4}$, ventral $1\frac{1}{3}$ Pale brown Dusky brown streak from occiput to snout tip Dusky brown band from spinous dorsal origin, through eye and over cheek, second from third to fifth dorsal spines, including pectoral base to ventral base, third from front of soft dorsal toward front of soft anal, fourth across caudal peduncle anteriorly, narrow, fifth at caudal base, pale, narrow Terminal half of second membrane of spinous dorsal black. Soft dorsal, anal and caudal grayish terminally, 2 former dusky submarginally and edge narrowly white Large black ocellus with narrow white edge, on soft dorsal front Ventral whitish, outer edges dusky Length 60 mm

Natal beach, Durban

Heniochus acuminatus (Linné)

Depth $1\frac{3}{5}$, head $3\frac{1}{3}$, width 2, snout $2\frac{1}{2}$, eye $3\frac{1}{3}$, $1\frac{1}{3}$ in snout, equals interorbital, maxillary $4\frac{1}{2}$ in head, $\frac{1}{2}$ in snout, expansion $3\frac{3}{5}$ in eye, preopercle edge minutely serrated. Rakers 12, short, feeble Scales with 8 to 10 basal striae, 87 to 90 apical points and 13 to 16 rows of basal segments D XI, 26, fourth spine long as combined head and body, fifth ray $1\frac{3}{5}$ in head, A III, 19, third spine $1\frac{1}{2}$, fourth ray $1\frac{1}{3}$, caudal $1\frac{3}{5}$, truncate behind, pectoral $1\frac{1}{3}$, ventral $2\frac{3}{10}$ in combined head and body. White, with 3 broad, black transverse bands, first through eye obsolete, second from first 4 dorsal spines to ventrals, also along front anal edge, third from fifth to ninth dorsal spines to hind half of soft anal Pectoral and caudal whitish Ventral black Length 145 mm

Natal

ACANTHURIDAE

Hepatus triostegus (Linné).

Depth $1\frac{7}{8}$, head $3\frac{1}{3}$, width $1\frac{4}{5}$, snout $1\frac{1}{3}$, eye $4\frac{1}{4}$, $2\frac{1}{3}$ in snout, $1\frac{4}{5}$ in interorbital, maxillary $4\frac{1}{3}$ in head; interorbital 3, convex. Rakers 5 + 7, short, feeble. Scales with 12 to 17 apical points and 3 rows transversely D X, 24, fifth spine 2 in head, first ray $1\frac{3}{5}$, A. III, 22, third spine $1\frac{1}{3}$, first ray $1\frac{3}{4}$, caudal $1\frac{1}{3}$, little emarginate, pectoral $1\frac{1}{3}$, ventral $1\frac{1}{4}$. Olive brown, under surface white. Side with 6 black transverse bands, first crossing eye and second to pectoral base, which black Fins dark neutral, especially anal. Pectoral pale Ventral with neutral dusky, borders whitish. Dusky streak back from side of chin till opposite anal front Length 194 mm.

Natal.

SIGANIDAE

Siganus nebulosus (Quoy and Gaimard)

Depth 2⅔, head 3⅔, width $2\frac{1}{10}$, snout 2⅓, eye 3, 1¼ in snout, 1 in interorbital, maxillary 3⅔ in head, not quite to hind nostril, expansion 2¾ in eye, teeth ½½ biscuspid incisors, interorbital 3 in head, convex Rakers 7 + 22, short points Scales minute, compact D I, XIII, 10, I, sixth spine 2 in head, fourth ray 2½, A VII, 9, I, third spine $2\frac{1}{10}$, first ray 2⅓, caudal 1, deeply emarginate, caudal peduncle depth 5, pectoral 5, ventral 1⅔ Purplish brown, with nebulous shades Fins grayish, several darker streaks obliquely on soft dorsal, anal and transversely on caudal Ventral slightly dusky terminally Length 150 mm

Delagoa Bay

SCORPAENIDAE

Scorpaena durbanensis *Gilchrist and Thompson*

Depth 2½, head 2¼, width 1⅔, snout 3⅔, eye 4¾, 1⅓ in snout, maxillary 1¾ in head, to hind eye edge, expansion 1¼ in eye, fine teeth, in bands, in jaws, on vomer and palatines, interorbital 7¾ in head, 1⅔ in eye, deeply concave Flap each side of snout tip, 1 from each preorbital spine, long supraocular long as snout, preopercle with 5 spines and marginal flaps Rakers 5 + 8, low points Scales 38 + 2, tubes 22 +, scales 6 above, 13 below, 4 predorsal, 5 or 6 flaps along lateral line, 11 to 13 basal striae D XII, 9, fifth spine 2⅔ in head, third ray 2⅓, A. III, 5, second spine 2⅓, second ray 2⅓, caudal 1⅓, hind edge convex, caudal peduncle depth 4, pectoral 1½, ventral 1⅔. Dusky brown, splashed paler on sides, whitish below. Fins pale gray, dorsals with 4 ill defined basal blotches On caudal 3 broad dark transverse bands, same on pectoral and anal Ventral pale basally, slightly dusky terminally Length 103 mm

Off Bluff southeast, Natal coast

Scorpaenopsis cirrhosus (Thunberg)

Depth 3⅓, head 2⅔, width 1¾, snout $3\frac{1}{10}$, from snout tip, eye 6⅓, 2 in snout, without flap, maxillary 2 in head, to front pupil edge expansion equals eye, villiform bands of teeth in jaws, on vomer, none on palatines, bony interorbital 7 in head. Rakers 5 + 10, low tubercles Scales 48 +, tubes 25 + 2, 7 scales above, 20 below, 6 predorsal, 6 to 12 basal striae, apical points 60 to 68 with 3 to 7 transverse series D XI, 10, fourth spine 2⅓ in total head length, third ray 2⅔, A III, 5, second spine 2⅔, second ray $2\frac{1}{10}$, caudal 1¾, rounded behind; pectoral 1½, ventral 1⅓. Brown above, whitish below. Chiefly blotched and clouded with dusky, also finely mottled with various darker shades Fins with waved dusky lines and bands or blotches. Blackish marginal blotch over seventh to tenth spinous dorsal membranes Paired fins with waved streaks of brown and dusky Length 230 mm

Natal coast, in 25 fathoms

Scorpaenopsis gibbosus (Schneider)

Depth 2⅕ to 2⅗, head 2¼ to 2¾, width 1¼, snout 3, from snout tip, eye 6⅔ to 7, 2 to 2⅕ in snout, 1¾ to 2 in interorbital, maxillary 1⅘ in head, to eye center or hind eye edge, expansion equals eye or slightly greater to 2 in snout, bands of villiform teeth in jaws, on vomer, none on palatines, interorbital 3⅘ to 4 in head, deeply concave, quadrate depression at occiput Rakers 4 + 7, low tubercles Scales 35 + 5, tubes 21 +, 7 scales above, 16 below, 6 predorsal, 8 to 16 basal striae, 32 to 40 apical points in 3 transverse series D XII, 10 fourth spine 3⅗ to 4⅕ in total head length, fourth ray 2¾, A III, 6, second spine 2⅗, third ray 2¼, caudal 1⅘ to 2, convex behind, caudal peduncle depth 3⅘, pectoral 1⅗ to 1⅘, ventral 1⅘ to 1¾ Dull sea green to neutral dusky, clouded obscurely with dusky Belly pale ecru drab Fins largely mottled dusky Length 235 to 260 mm

Natal, two examples

Agriopus spinifer Smith

Depth 3⅔, head 3¾, width 2, snout 2⅗, eye 3, maxillary 4⅕, interorbital 2⅘ in eye Gill opening 1⅗ in eye Skin of trunk, except breast and belly, with sharp scattered asperities Pores 25 in lateral line D XX, vi, 7, fifth spine slightly less than head, sixth ray 2, A II, —?, second spine 2⅗, third ray 1⅗, caudal 1⅕, slightly emarginate, pectoral and ventral subequal, slightly longer than head Drab gray, with 6 slightly darker transverse broad bands Obscure scattered small black spots along lateral line, another row from above gill opening back nearly opposite vent and few back from pectoral axil Dorsals pale basally, neutral gray terminally, black spot on first membrane terminally and another larger on sixth to eighth membranes terminally Caudal pale brown, with 3 or 4 dusky waved lines Anal pale basally, dark blotch on front rays and spines terminally Pectoral and ventral gray, spotted with dusky, most distinct terminally Length 160 mm

Natal coast.

Choridactylodes natalensis Gilchrist

Depth 3, head 3½, width 1⅓, snout 2¾, from snout tip, eye 4⅕, 1½ in snout, 1⅗ in interorbital, maxillary 3 in head, reaches pupil, expansion 1⅗ in eye, interorbital 3 in head, transverse occipital depression deep, strong, broad, preopercle spine and 1 at preorbital Rakers 3 + 7, low tubercles Skin finely papillose and papillae extend over fins, many short cutaneous tentacles on dorsal fins and 13 along lateral line, followed by 1 or more on caudal base; chin with flaps and tentacles. D. XIV, 9, third spine 1⅗ in head, third ray 1⅗, A II, 8, second spine 4⅕, sixth ray 1⅓, caudal 1½, convex behind, P 9, 3, long as head, ventral 1 in head. Brown, mottled with neutral to blackish Caudal with blackish basal band and broad submarginal Length 140 mm.

Durban Bay.

PLATYCEPHALIDAE

Platycephalus insidiator (Forskål)

Depth 11 to 12⅔, head 3¼, width 5⅓, snout 3⅓ to 3⅔, from snout tip, eye 7 to 8, 2 to 2⅓ in snout, 1½ to 1⅔ in interorbital, maxillary 2⅗ to 4 in head, ⅓ in eye or ½ with age, interorbital 4½, broadly depressed, concave Rakers 6 + 11, lanceolate Scales 76 or 77 +, 11 or 12 above, 20 or 21 below, 21 to 23 predorsal, 9 or 10 basal striae, 28 or 29 apical points with 4 rows of basal segments. D VIII—I, 12, second spine $2\frac{1}{10}$ to 2⅔ in total head length, first ray 2⅓ to 2⅗, A 13, I, fifth ray 3½ to 4, caudal $1\frac{9}{10}$, convex behind, caudal peduncle length 2⅔ to 2⅘, pectoral 2¼ to 2⅓, ventral 1⅔ Back umber brown, sides finely specked dusky Black spot on opercle, another opposite soft dorsal front, 1 near last third of depressed soft dorsal, 1 on caudal peduncle above Body whitish below Spinous dorsal grayish Soft dorsal pale gray, with several brown spots on each ray Caudal gray, with upper and lower black longitudinal band, also longitudinal brown band on lower part of upper half Pectoral brown, rays finely spotted darker Ventral similar, paler Length 213 to 275 mm

Two from Delagoa Bay, and one from Natal

Platycephalus malabaricus Cuvier

Depth 8, head 3⅓, width 1½, snout 3½, from snout tip, eye 5¾, 1⅔ in snout, 1⅔ in interorbital, maxillary 2½ in head, to eye, bony interorbital 7½ in head, level. Rakers 6 + 12, lanceolate Scales 78 + 4, tubes 53 +, 8 above, 14 below, 15 predorsal, 8 to 10 basal striae, 31 to 33 apical points with 6 to 8 rows of basal segments D I, VIII—I, 12, third spine 2 in total head length, second ray 2⅔, A 12, I, second ray 4¼, caudal 1⅞, convex behind, caudal peduncle depth 7½, pectoral 2⅓, ventral 1⅔ Dark chocolate above, speckled with dusky, vinaceous buff below Dorsals dark, rays with blackish spots Caudal brown, with osbcure darker blotches Paired fins deep brown, former finely dotted with dusky Length 280 mm

Tugela River, in 60 fathoms

Platycephalus tentaculatus Rüppell

Depth 9½, head 3, snout 3¼, from snout tip, eye 6¾, 2 in snout, 1⅘ in interorbital; maxillary 2⅔ in head, to pupil, interorbital 4, depressed, slightly concave Rakers 5 + 11, lanceolate Scales 56 + 2, rows of scales 80 + 7, 8 above, 15 below, 13 predorsal, cranium largely scaly, head otherwise naked, 9 to 14 basal striae, apical points 31 to 37 with 2 to 5 basal series. D. IX—I, 11, I, second spine 2⅓ in total head length, first ray 2⅓, A. 12, I, fifth ray 3⅘; caudal 2, hind edge convex; pectoral 2¼, ventral 1⅘ Umber above, with scattered darker dots, below white Dorsals gray, spinous fin with 4 rows of rounded neutral black spots, none larger than pupil, soft fin with 3 or 4 neutral black spots on each ray. Caudal gray, with 6 obscure series of darker spots Pectoral olive, each ray with 10 dusky dots Ventral dusky brown terminally Length 223 mm

Delagoa Bay.

PERISTEDIIDAE

Peristedion adeni Lloyd

Depth 5¼, head 2¼, width 1½, snout 1¾, eye 7, 4 in snout, 1$\frac{1}{10}$ in interorbital, maxillary 3, ⅝ to eye, expansion 2$\frac{1}{10}$ in eye, mental barbel 3⅓ in head, with numerous tentacles, interorbital 6⅔ in head, preopercle spine little longer than eye Rakers 4 + 18, lanceolate. Median bucklers 22 + 3, 4 rows transversely spinous D VIII, 14, second spine 3⅔ in head, fifth ray 4⅓, A 15, fifth ray 5½, caudal 2¾ little concave behind, pectoral 2½, ventral 2¼ Largely pale wood brown, gill opening, breast and pectoral neutral gray Iris pale slaty Spinous dorsal edge narrowly blackish Length 250 mm

Natal coast, in 33 fathoms

TRIGLIDAE

Trigla capensis Cuvier

Depth 5¼ to 5⅔, head 3⅓ to 3⅔, width 1⅗ to 1¾, snout 2⅓ to 2¼, eye 4⅓ to 4⅔, 1¾ to 2 in snout, 1⅓ in interorbital, maxillary 2⅓ to 2⅗ in head, to eye, expansion 1⅞ in eye, interorbital 3⅗ to 4¾ in head, concave Rakers 2 + 10, lanceolate Scales 118 to 120 +, tubes 66 to 72 + 5, 9 scales above, 35 below, 17 predorsal, 5 to 10 basal striae, 25 spines along each side of dorsal bases D IX—iii, 13, i, first spine 1¾ to 1⅞ in head, first branched ray 2¾ to 2⅘, A. 15, i, fourth ray 3⅓ to 3⅔, caudal 1¼ to 1⅔, deeply emarginate, ventral 1⅗ to 1⅓, pectoral i, 9—3, 2⅓ to 3⅓ in combined head and body "Color brownish red, belly silvery Pectoral inside pale brown with dark blue and 12 white spots, surrounded with pale blue, outside dark greenish, with white rays banded pink and red " Length 210 to 395 mm

Natal, two specimens

DACTYLOPTERIDAE

Dactyloptena orientalis (Cuvier)

Depth 5¾, head 4, snout 2⅗ in head, eye 2¾, bands of 5 irregular series of teeth in jaws, maxillary 2$\frac{1}{10}$, to hind eye edge, interorbital 1½ in head, deeply concave Rakers 3 + 4, rudimentary rough tubercles Scales 45 +, transversely 24 at anal origin, 19 from isthmus to ventral. D I—I—VI—8, first spine elongate filament 2⅗ in combined head and body, second ray 1⅖ in head, A. 6, second ray 1⅔, P 33, reaches caudal base, caudal truncate, 1$\frac{1}{10}$ in head, ventral 1⅓ "Pale brown, blotched with pale gray. Dorsal spines and rays barred brown and yellow Caudal yellow and brown. Pectoral brown, rays barred yellow, membranes with dark spots of brown and black " Length 158 mm.

Delagoa Bay.

POMACENTRIDAE

Pomacentrus annulatus Peters

Depth 1⅞, head 3, snout 3¾ in head, eye 2⅞, maxillary 3⅒, not quite to pupil, teeth uniserial, compressed, cutting edge continuous, interorbital 3⅝ in head, broadly convex, narrow preorbital entire, few weak serrae above angle Rakers 5 + 9, lanceolate Scales 18, pores 9 + 3, 3 scales above, 9 below, 10 predorsal, 3 rows on cheek, 5 to 7 basal striae, 79 to 104 apical points with 4 or 5 rows of basal segments D XIII, 12, fourth spine 1⅝ in head, fourth ray 1⅓, A II, 11, second spine 1⅞, fifth ray 1⅝, caudal 1, little emarginate, caudal peduncle depth 2¼, pectoral 1⅛, ventral 1 "Pale yellow with 4 or 5 black bars Eye silvery and little golden Caudal yellowish. Ventral black" Length 70 mm

Delagoa Bay

Differs from Bleeker's figure of *Dischistodus annulatus* in having black blotch on front of muzzle and spinous dorsal blackish above

CICHLIDAE

Tilapia rumsayi Gilchrist and Thompson

Depth 3, head 2⅔, width 2⅛, snout 3⅝, from snout tip, eye 3⅓, maxillary 3⅛, not quite to eye, interorbital 4⅛ Rakers 3 + 7, short Scales 13 + 9 + 2, 3 above, 9 below, 14 predorsal, 4 rows on cheek to preopercle ridge, 11 basal striae, 34 apical points and 6 rows transversely less developed D XIII, 7, fifth spine 2⅓ in total head length, fifth ray 2, A III, 5, third spine 2⅘, third ray 3, caudal 1⅝, slightly emarginate behind, pectoral 1½; ventral 1⅘ Nearly drab, below whitish About 10 dusky cross bars, fading below Opercular dark spot size of pupil Faint dusky bar from lower front eye edge to maxillary end Fins brownish, ventral paler Length 40 mm

Zingazi Lake, Zululand, one example

LABRIDAE

Lepidaplois natalensis (Gilchrist and Thompson)

Depth 2⅞, head 2⅝, width 2¼, snout $1\frac{9}{10}$, eye 7, 4 in snout, 2¼ in interorbital, maxillary 2⅞ in head, ⅔ in snout or nearly to front nostril, canines ⅘, bony dental plate along inside each row of teeth, interorbital 3⅓ in head, broadly convex Rakers 9 + 11, short Scales 50 + 8, 13 above, 16 below, 33 predorsal, 21 to 23 basal striae, 9 rows of cheek scales, embedded, to preopercle ridge, none on flange, scales crowded on predorsal, breast, body edges and over most of fins basally. D XIII, 9, I, third spine 3 in head, fourth 4⅓, sixth ray 2⅝; A III, 11, I, third spine 4⅒, sixth ray 2¼, caudal 1⅔, convex behind, caudal peduncle depth 2¼, pectoral 2, ventral 2 Dull brown On head, at pectoral base and above, small, scattered, neutral gray spots Dorsal spines little dusky terminally. Ventral with dusky gray, other fins brown Length 452 mm

Natal coast

Lepidaplois diana (*Lacépède*)

Depth 3, head 2⅝, width 2¼, snout 2½, eye 6⅜, 2¾ in snout, 1⅝ in interorbital, maxillary 2⅗ in head, to hind nostril, canines ¼, teeth uniserial, strong, conic, with strong, broad, flat dental plate inside in each jaw, interorbital 4, convex, preopercle edge finely dentate, with slight notch below Rakers 5 + 9, lanceolate Scales 31 + 2, 3 above, 10 below, 19 predorsal, 12 rows across cheek to preopercle angle, smaller on breast and chest, 19 or 20 basal striae, 25 or 26 apical D XII, 10, I, last spine 3 in head, fifth ray 2⅜, A III, 12, I, third spine 3, third ray 2⅝, caudal 1⅜, convex behind, pectoral 1¾, ventral 2½ Head and chest dark purplish brown, trunk pale brown Below soft dorsal 3 rows of small dark or black spots, 1 at tip of each scale, also on upper surface of caudal peduncle Black spot, little larger than others, on last scale of lateral line above median tube traversing scale Pectoral rosy, axilla pale orange Ventral dusky olive basally, paler terminally Other fins olive dusky on spinous portions, rayed portions pale yellowish. Length 243 mm

Natal coast, in 28 fathoms

Duymaeria nematopterus Bleeker

Depth 1⅞ to 2½, head 2¾ to 2⅞, snout 3 to 3⅜, eye 4¾ to 5¼, maxillary 2⅝ to 3¼, not quite to eye, expansion 2¾ in eye, interorbital 4½ to 5⅛ in head, slightly concave Rakers 5 + 6, short, spinous Scales 23 to 25 + 2, 2 above, 6 below, 4 predorsal, 2 rows on cheek and 1 scale on preopercle flange, 12 or 13 basal striae 20 to 28 apical points. D X or XI, 9, I or 10, I, seventh spine 2⅛ to 2⅝ in head, sixth ray 1⅝ to 2, A III, 9, I or 10, I, third spine 2⅝ to 2⅜, fourth ray 1⅝ to 2, caudal 1¼ to 1⅞, convex behind, caudal peduncle depth 2¼ to 2⅞, pectoral 1⅓ to 1¾, ventral 1⅛ to 1⅝ "Mauve gray and blue, lighter on belly, with black spots in 4 patches along back On lateral line black broken band ¾ to tail Pectoral area and belly yellowish Little black in tail root Eye pale salmon and silvery Behind eye black dots joining black markings Dorsal spines with black filaments, fin gamboge, rays and spines dark blue, also blue in caudal rays basally and gamboge and yellow terminally. Anal spine with red point, spines pale blue, membranes yellowish brown. Ventral rays pale blue, membrane transparent." Length 100 to 143 mm

Four from Delagoa Bay

The largest has first ventral ray filamentous or reaching midde of anal base and large neutral black blotch on opercle. Color notes of all these individuals show only degrees of variation.

Stethojulis interrupta (Bleeker)

Depth 3⅔, head 3⅕, snout 3⅕; eye 5⅔, maxillary 4⅓, interorbital 4⅗, broadly convex Rakers 7 + 12, lanceolate Scales 20, 6 + 2, 3 above, 10 below, 11 predorsal, 13 to 15 basal striae, apical 10 to 14 D. IX, 11, I, last spine 4⅓ in head, fourth ray 3, A II, 11, I, second spine 5, third ray 3⅓, caudal peduncle depth 2⅔, caudal 1⅓, convex behind, pectoral 1⅗, ventral 2¼ "Back rose pink, sides pale blue, turquoise band along back and 2 blue lines over face, another half way in belly to tail On center of body 3 bands of pale olive green crossing. Black spot in pectoral base, vermilion one behind Eye rose. Dorsal rose and yellow Caudal dark orange. Ventral transparent" Length 111 mm

Delagoa Bay

Stethojulis kalosoma (Bleeker)

Depth 3⅗, head 3, snout 2, eye 5⅗, maxillary 4, ⅗ in snout, interorbital 4⅗ in head, convex Rakers 6 + 9, lanceolate Scales 19, 6 + 2, 3 above, 9 below, 10 predorsal, 18 to 21 basal striae, 11 or 12 apical D IX, 11, I, ninth spine 4⅗ in head second ray 3⅕, A II, 11, I, second spine 5½, first ray 3⅗, caudal 1⅗, convex behind, caudal peduncle depth 3, pectoral 1½, ventral 2¼ Olive above, most scales with median horizontal pale streak From eye, above pectoral axil to caudal base medially narrow pale dark edged line, below on costal region and above anal numerous small blackish spots or dots. Head brown above, below whitish, like belly. Vertical fins gray, dorsals finely vermiculated with dusky gray. Paired fins whitish Length 120 mm

Delagoa Bay

Cheilio inermis (Forskål)

Depth 6⅔ to 7¾, head 3 to 3⅕, snout 2⅕ to 2⅓, eye 7⅕ to 7⅓, maxillary 3 to 3⅗, expansion 2 to 3 in eye, interorbital 6⅔ to 9, nearly level Rakers 7 + 11, lanceolate Scales 46 or 47 + 2, 5 to 8 above, 11 below, 9 or 10 predorsal, basal striae 22 to 27, apical 38 D. IX, 13, I, ninth spine 4½ to 4⅗ in head, eighth, ray 4 to 4⅕, A II or III, 12, I, to 14, I, second spine 12¼, fourth ray 4 to 4⅕, caudal 2 to 2⅕, little convex behind, pectoral 2⅗ to 3, ventral 4½ "Upper half of body bright olive green. Scales edged darker, with median black lateral band to caudal base Belly silvery, with gamboge edging to scales Eye silvery, with little olive Dorsal rays dark green half way, remainder yellow. Caudal deep gamboge Pectoral white Ventral rays tipped pale claret, rest pale blue" Length 223 to 280 mm

Delagoa Bay, three examples

Novaculichthys macrolepidotus (Bloch)

Depth 3⅗ to 3⅔, head 3⅗, snout 3⅕ to 3⅓, eye 4⅓ to 5⅕; maxillary 3½ to 3⅔, not quite to eye, canines ⅓, interorbital 5 to 5½, convex.

Rakers 8 + 7, lanceolate Scales 20 + 5 + 1, 3 above, 9 below, row behind and below eye on suborbitals, basal striae 43 to 48, apical 55 to 75 D IX, 13, I, ninth spine 4⅔ to 4⅘, second ray 2⅘ to 2½, A III, 13, I, third spine 3½ to 4¼, second ray 2⅓ to 2½; caudal 1¼ to 1½, little convex behind, caudal peduncle depth 2, pectoral 1⅗ to 1⅞, ventral 1⅒ to 1⅔ "Bright olive green, with faint yellow reticulated lines across body Median half of body with broad black band, fading towards tail Head crossed with gray bands, on opercle black lunar mark, with smaller streaks on lower face, through eye, over snout of green and yellow Dorsal green, with bright red spot and streaks, between first and second spines black spot Caudal and anal tipped red, membrane bases also red in places Ventral bright green, bases joined by black mark Eye green" Length 102 to 138 mm

Three from Delagoa Bay.

A small one has "black bar in lower center of body with 2 black spots following Head with more ornamentation of red salmon bands and black markings lined with red behind eye."

Hemipteronotus pentadactylus (Linné)

Depth 2¾, head 3¼, width 2⅒, snout 2; eye 5⅓, 3 in snout, 1⅓ in interorbital, maxillary 3¾ in head, to front nostril, interorbital 5 Rakers 7 + 10, lanceolate Scales 22 + 3 + 2, 5 above, 10 below, 9 rows on cheek, 66 to 73 basal striae, apical 48 to 50 D II, VII, 11, I, second spine 2⅔ in head, tenth ray 2⅓, A III, 12, I, first ray 3, caudal 1½, convex behind, pectoral 1⅓, ventral 2 Dull brown, fins faded uniformly pale No distinct dark spot at depressed pectoral tip Length 153 mm.

Durban coast

CALLYODONTIDAE

Scarichthys caeruleopunctatus (Rüppell)

Depth 3 to 3⅓, head 3 to 3¼, snout 2⅔ to 2⅘, eye 5⅓, canines 4, upper external canines forward, flaring out on all sides, mouth 3⅘ to 4, gape not quite to hind nostril, interorbital 3⅔ to 4⅓ Rakers 4 + 9, short, flexible Scales 20, (4 double) 1 + 2, 2 above, 6 or 7 below, 4 or 5 predorsal, single row on cheek; basal striae 24, apical 27 D IX, 10, I, third spine 2¼ in head, fifth ray 2⅓, A III, 9, I, third spine 3⅓, fifth ray 2⅓; caudal 1¼, little convex behind, pectoral 1⅔, ventral 1⅘. "Gray blue, with numerous black spots over body, on each scale, which with pale or yellow edge, 3 black spots. Head and chin well spotted Over top of eye black Fin rays gamboge or transparent, anal and some dorsal rays little darker than others; pectoral rays pale, caudal little darker at root." Length 186 to 223 mm.

Two from Delagoa Bay.

Leptoscarus viridescens (Rüppell)

Depth $2\frac{3}{5}$ to $2\frac{4}{5}$, head 3 to $3\frac{1}{3}$, snout $2\frac{3}{5}$ to $3\frac{1}{4}$; eye $4\frac{3}{4}$ to 5, mouth gape $3\frac{1}{2}$ to 4, teeth $\frac{11}{20}$ to $\frac{13}{20}$ irregular, enlarged, forward in jaws, interorbital 4 to $4\frac{1}{3}$ Rakers 3 + 10, short, flexible. Scales 19, 4 to 6 + 2, 2 above, 6 or 7 below, 4 or 5 predorsal, 1 row on cheek; basal striae 20 to 25, apical 25 to 29 D IX, 10, I, spines pungent, seventh spine $2\frac{1}{5}$ to 3 in head, fourth ray $1\frac{2}{3}$ to $2\frac{2}{5}$, A III, 9, I or 10, I, third spine $3\frac{3}{5}$ to $4\frac{1}{3}$, fourth ray $2\frac{1}{2}$ to $3\frac{1}{10}$, caudal $1\frac{2}{5}$ to $1\frac{1}{2}$, slightly convex behind, caudal peduncle depth $2\frac{1}{5}$, pectoral $1\frac{1}{2}$ to $1\frac{7}{8}$, ventral $1\frac{3}{4}$ to 2 "Greenish gray, with darker in scales of dorsal base, or an irregular black spot in center of each Some dark coloring on face and head Anal largely black, except narrow transparent median line Caudal greenish gray" Length 143 to 170 mm.

Three from Delagoa Bay

Some noted as "brownish yellow, each scale with pale gray center with small white dots Narrow white band in center of body above pectoral Fins smoky, with some brownish yellow Caudal dark yellowish"

Jordan and Seale have confused a Samoan example with *Scarus* (*Calliodon*) *coeruleopunctatus* Rüppell, as a glance at Rüppell's figure shows They figure a young example of *Leptoscarus viridescens*, which in many ways resembles my examples They do not show the elevated large basal dorsal scales, as in Rüppell's figure and my smaller example, nor the transverse dark bars across the last dorsal and anal rays Rüppell's figure shows the hind part of spinous dorsal and all of soft dorsal and anal, with oblique darker lines, also hind caudal edge white Jordan and Seale give the depth 3 50, though even if the total length of their specimen was intended, it is scarcely over 3

Callyodon collana (Rüppell)

Depth $2\frac{4}{5}$, head 3, snout $2\frac{2}{5}$, eye $5\frac{1}{3}$, gape 5, upper lip broad, covers $\frac{3}{4}$ of upper jaw; no canines, interorbital $3\frac{4}{5}$ Rakers 11 + 30, short, flexible Scales 20, (3 double) 2 + 2, 2 above, 6 below, 6 predorsal, 2 rows on cheek and preopercle flange partly scaly, basal striae 22, apical 20 D IX, 10, I, fifth spine $2\frac{3}{5}$ in head, first ray $2\frac{1}{2}$, A III, 10, I, third spine 4, fourth ray $2\frac{2}{5}$, caudal $1\frac{3}{5}$, expanded slightly convex behind, pectoral $1\frac{3}{5}$, ventral $1\frac{3}{5}$ "Yellow, with pale blue patches at intervals over body. Eye silvery blue above Scales with various blue shades in centers Blue streak over upper lip and beneath eye Dorsal rays edged blue Anal rays blue basally, terminally with blue edge Outer 2 caudal rays bright blue Blue streak on first pectoral ray" Length 163 mm

Delagoa Bay, one specimen.

GOBIIDAE

Gobius giurus Buchanan-Hamilton

Depth $5\frac{3}{5}$ to $5\frac{2}{3}$, head $3\frac{1}{3}$ to $3\frac{1}{4}$, width $1\frac{2}{3}$ to $1\frac{4}{5}$, snout $2\frac{4}{5}$ to 3, from snout tip, eye 7, $2\frac{2}{5}$ to $2\frac{1}{2}$ in snout, maxillary $2\frac{1}{4}$ to $2\frac{1}{3}$ in head, to eye or front pupil edge, teeth biserial, large, conic, outer fewer, wider spaced and much larger, interorbital width $4\frac{4}{5}$ to 5 in head, bony width $\frac{2}{3}$ of eye. Rakers 1 + 8, short Scales 31 to 33 + 3 or 4, 12 transversely, 19 predorsal, none on head except occiput and small on caudal base, ciliated D VI—9, I, second, spine 2 to $2\frac{1}{10}$ in head, first ray $2\frac{1}{3}$ to $2\frac{1}{2}$, A I, 7, I, fifth ray $2\frac{2}{5}$ to $2\frac{4}{5}$; caudal $1\frac{1}{5}$, pectoral $1\frac{1}{2}$ to $1\frac{2}{3}$, ventral $1\frac{1}{2}$ to $1\frac{3}{5}$ Pale olive brown above white below Each row of lateral scales with dark median line Side with row of 5 large, dark brown spots, all much larger than eye. Dorsals, caudal and pectoral with dark spots, on caudal formed as 7 transverse dusky-gray bands Length 185 to 205 mm

Umhlatuzi River, Zululand, two specimens.

Gobius criniger Valenciennes

Depth 4, head 3, width $1\frac{2}{3}$ to 2, snout $3\frac{1}{4}$ to $3\frac{1}{3}$, eye $3\frac{3}{4}$ to 4, $1\frac{1}{5}$ to $1\frac{1}{3}$ in snout, maxillary $2\frac{2}{5}$ to $2\frac{3}{5}$, little beyond front of eye, fine bands of teeth in jaws, outer row little enlarged, especially 1 curved on each side of mandible and little prominent in adult; tongue broadly convex in front, interorbital $1\frac{3}{4}$ to 2 in eye, slightly concave Rakers 1 + 6, robust points Scales 28 or 29 + 4, 11 to 13 transversely, head, predorsal, breast and median ventral line to anal naked, 34 or 35 basal striae, 23 to 30 + 23 to 30 apical points. Across cheek horizontally from maxillary end 2 double series of fine papillae, row along close below eye and another along lower face of mandible and lower side of head with branch up along preopercle flange D VI—I, 9, I, second spine 2 in head, first branched ray $1\frac{4}{5}$ to 2, A I, 9, I, sixth ray $1\frac{4}{5}$, caudal $1\frac{1}{10}$ to $1\frac{1}{5}$, rounded, pectoral $1\frac{1}{5}$ to $1\frac{2}{5}$, ventral $1\frac{2}{5}$ to $1\frac{1}{2}$ Light brown. Pair of dusky-brown transverse bands across predorsal Round dusky basal caudal blotch and 2 paler on side medianly, just below and before each dark saddle of back, which otherwise with deep brown spots Dark blotch on opercle and another on cheek Dusky blotch at spinous dorsal base, another at last dorsal ray bases and on front of caudal peduncle above Dorsals whitish, with 3 longitudinal rows of large blackish spots Caudal with 6 dark transverse bands. Anal and ventral shaded dusky gray terminally Pectoral brownish. Length 98 to 111 mm.

Delagoa Bay, three examples.

Gobius polynema (Bleeker)

Depth $5\frac{2}{5}$, head 4, width $1\frac{1}{2}$, snout 4, eye $3\frac{1}{5}$, long as snout, maxillary $3\frac{1}{5}$, to first $\frac{1}{3}$ in eye, teeth fine, in narrow bands in jaws, outer row enlarged, tongue broadly convex in front, interorbital 7 in head, narrow, concave. Rakers 5 + 11, short points. Scales

26 + 3, 9 transversely, 14 predorsal, 9 basal striae, 33 + 34 to 38 apical points, 3 horizontal rows of fine papillae across cheek D VI—I, 10, second spine 2 in head, ninth ray 1⅝, A I, 9, i, eighth ray 1⅓, ventral 1, caudal 2⅛ in combined head and body, pointed, pectoral 3, caudal peduncle depth 2⅓ in head Pale purplish gray Fins neutral gray, darker terminally Large black, light edged ocellus on upper caudal rays basally, little larger than eye Length 123 mm

Delagoa Bay

OPISTHOGNATHIDAE

Opisthognathus muscatensis Boulenger

Depth 3¾ to 3⅘, head 3⅓ to 3⅝, width 1¼, snout 5⅓ to 5⅘, eye 4⅔ to 5, maxillary 1⅔, expansion 1⅓ to 1⅝ in eye, teeth small, strong, conic, in band in each jaw, outer row enlarged, interorbital 6½ in head, 1¼ to 1⅝ in eye, slightly concave Rakers 15 + 24, lanceolate No scales on head and trunk anteriorly, otherwise largely imbedded D XI, 15, i, spines 2⅓ to 2⅔ in head, A 18, rays 2¼ to 3, caudal 1½ to 2, rounded behind, pectoral 2 to 2¾, ventral 1¾ to 1⅞ "Pale olive, spots and markings on silvery." Color pattern quite variable, sometimes "with mottlings of umber and olive in pinkish, some white in places" Length 310 to 354 mm

One from Port Shepstone, in 16 fathoms, and Natal

XIPHASIIDAE

Xiphasia setifer Swainson

Depth of head 1⅔ its length, head 15⅙, width 2⅔, snout 4, obtuse, eye 3⅓, maxillary 3¼, row of slender, compressed teeth in each jaw forward, below pair of very long curved slender, wide-set canines ⅔ of eye, interorbital 1⅓ in eye, concave Rakers 1 + 7, feeble points Skin smooth, naked D 114, begins over eye center in interorbital, height 1½ in head, A 107, inserted slightly less than head length behind head, C. 10, rounded behind, without filaments, 2⅔ in head, P 11, fin 2⅒, ventral 2⅔. "Mauve, with paler bands, Fins dark banded" Dull brown generally, with dusky pigment dots on back Dorsal neutral black, other fins pale brownish, anal dusky posteriorly and marginally Caudal neutral dusky, blackish terminally Length 203 mm

Winkel Spruit, south Natal coast

CARAPIDAE

Carapus gracilis (Bleeker)

Depth 16⅔, head 11, width 2, snout 4⅓, eye 4, mouth cleft 2, maxillary extends little beyond eye, teeth fine, uniserial in jaws, row of 4 on vomer medianly little larger and row on each palatine, interorbital 4⅓, slightly convex. Rakers 3 + 8, short, feeble D. 115 ?, fin much lower than anal, predorsal space 1⅓ in head, A. 118 ?, origin just behind head, vent slightly before pectoral origin, caudal very small, rounded behind; pectoral 4 in head Ecru drab, with obscure mottlings of darker, mostly as circles or irregular small rings, even extending into gill openings Fins clear whitish, evidently transparent Length 160 mm

Natal coast, in 120 fathoms

BALISTIDAE

Balistes ringens Linné

Depth 2, head 3⅙, width 1⅞, snout 1⅓, eye 5¾, entirely before gill opening, interorbital 2⅞, preorbital groove ⅔ in snout Gill opening 3⅓ in head Scales 48 + 4, 19 transversely D II—I, 27, I, first spine 2⅓ in head, robust, finely asperous in front, second branched ray 2⅓, A I, 24, I, second branched ray 2⅙, caudal 1¾, truncate, caudal peduncle depth 4⅗, P. I, 13, fin 2½ "Mauve, mixed with sienna, back darker and belly lighter. Some irregular vandyke-brown lines behind gills, over cheek deeper lines Fins pale gray, tipped with yellowish Caudal, with lunar white patch above, which brown and red, sides dark gray Brown dots on middle of pectoral" Length 233 mm

Port Shepstone, Natal coast, 6 fathoms

MONACANTHIDAE

Monacanthus pardalis Rüppell

Depth 1⅗, head 3¼, width 2⅓, snout 1⅕, upper profile slightly concave, eye 3⅗, 3½ in snout, 3⅕ in interorbital, interorbital 3⅖, convexly elevated Gill opening opposite eye, 3⅖ in head Skin finely asperous Dorsal spine inserted opposite front half of eye diameter, long as head, with single row of antrorse, low, short spines terminally, rays 36, sixth 2⅗ in head A 32, eighth ray 2⅗; caudal 1¼ convex behind, P 13, 2⅗ in head, ventral spine immovable, with 5 flaring short spines along each side Olive gray Caudal, dorsal membrane and ventral flap with neutral tint Soft dorsal, anal and pectoral pale grayish to whitish Length 125 mm.

Bluff trawl, Natal

Paramonacanthus choirocephalus (Bleeker)

Depth 2, head 3⅓, snout 1⅕ to 1¼, eye 3¼ to 3⅞, over gill opening, mouth small, terminal, interorbital 3¼ to 3½, convex D I, 24 to 26, spine (abnormally double once) 1⅗ to 1⅝ in head, with row of antrorse spines each side above, second dorsal ray 1⅝ to 2⅕, A 24 or 25, opposite and similar to soft dorsal, third ray 2⅕ to 3¼, caudal 1 to 1⅗, broadly fanlike with median rays much longest; P. 11, fin 2½. "Whitish, with 4 dark gray bars Dorsal yellow. Anal with first 3 rays yellow. Caudal with 2 half circular broad bands of black Eye silvery and pale gray" Length 73 to 100 mm.

Two from Delagoa Bay

OSTRACIONTIDAE

Ostracion gibbosus Linné

Depth 2⅗, head 4, carapace width 2⅓, snout 1⅓ in head, eye 3, interorbital 1¾, concave. Dorsal ridge with 2 spines at apex, strong, elevated, lateral ridge with 2 anterior spines at greatest width, posterior larger and small posterior spine present, bony bridge behind dorsal of 3 plates, broad suborbital spine Gill opening long as eye D I, 8, entirely before anal, first branched ray 1⅗ in head, A I, 8, first branched ray 1⅞, caudal 1, convex behind, pectoral 1⅗. Brown, clouded with dark olive Spines and upper and lower caudal edges whitish Iris pale gray Length 150 mm

Tugela River, in 60 fathoms

TETRODONTIDAE

Lagocephalus sceleratus (Gmelin)

Depth (contracted) 5¼; head 3¼, width 1 9/16, snout 1⅞, from snout tip, eye 4⅗, 2⅗ in snout, 2 in interorbital, mouth width 5⅗ in head, interorbital 2½, little elevated, flattened, gill opening 3⅗ Entire upper surface of head and predorsal minutely spinescent, head below and belly spinescent, lateral keel along whole lower side of head and body to caudal base Lateral line very distinct, forms big loup around eyes, across snout and occipital D I, 11, first branched ray 2¾ in total head length, A I, 9, first branched ray 2⅞, caudal 2, slightly concave behind, P II, 16, fin 2½ Back neutral brown, with many thick set neutral dusky spots, variable and crowded Along side, below eye, broad gray white lateral band Iris gray Triangular preoral whitish blotch Gill opening neutral tint Under surface of body and fins pale, pectoral and anal more gray white. Length 626 mm

Natal coast, in 30 fathoms

Sphoeroides unifasciatus (von Bonde)

Depth (contracted) 2½; head 2¾, width 1 Snout 2¼ in head, length ⅗ its width, eye 3 in head, 1¼ in snout, 1⅗ in interorbital, mouth width 3 in head, lips finely papillose, nasal tube short, at last ¼ of snout, each tube with pore in front and behind, interorbital 1⅗, level. Gill opening slightly less than eye All predorsal region with close-set spines to interorbital, larger and more scattered spines on belly, lips and caudal peduncle smooth. Fleshy ridge along each side of body posteriorly below D. I, 7, third branched ray 2⅓ in head, A I, 6, third branched ray 2¾, fin inserted close behind dorsal base, caudal 1⅗, truncate, slightly convex when expanded, pectoral 2⅓, rays I, 14, least depth of caudal peduncle 3¼ Back chocolate gray, finely and closely speckled with darker or brown Lower sides and under surface ecru drab, also lips. Fins pale, like belly, hind caudal edge broadly dusky Dusky transverse band across interorbital and large blackish blotch behind each eye superiorly. Dorsal base in blackish blotch. Length 80 mm

Natal coast, in 120 fathoms.

Somewhat suggestive of *Lagocephalus hamiltoni* (Richardson) from New South Wales, in its rather short body, reduced rays of dorsal and anal, and same features of coloration It differs, however, in the broad, black marginal band of the caudal and the dark markings on the top of the head Von Bonde does not mention the lower lateral longitudinal fold

Sphoeroides inermis (Schlegel)

Depth (contracted) $3\frac{1}{6}$ to 4, head $2\frac{3}{4}$ to 3, width $1\frac{1}{5}$ to $1\frac{2}{3}$, snout 2 to $2\frac{1}{10}$, eye $4\frac{1}{10}$ to $5\frac{2}{3}$, $1\frac{3}{5}$ to 3 in snout, $2\frac{3}{5}$ to $3\frac{1}{4}$ in interorbital, mouth width 4 to $4\frac{2}{3}$, interorbital $1\frac{9}{10}$ to 2, very slightly convex Gill opening equals or slightly more than eye Skin largely smooth, few obsolete minute spines at occiput, more developed and over most of front predorsal in young, belly with grooves longitudinally in which spines placed at intervals, grooves and spines not extending more than half way in space between end of depressed pectoral and vent, slight angle or keel along side of body below D ii, 8 or 9, second branched ray 2 to $2\frac{1}{4}$ in head, A ii, 7, second branched ray $1\frac{7}{8}$ to $2\frac{1}{3}$, caudal $1\frac{3}{5}$ to $1\frac{1}{3}$, hind edge slightly convex, pectoral $2\frac{1}{4}$ to $2\frac{1}{3}$, caudal peduncle depth 3 Slaty above, with whitish spots rather longitudinal along sides Young with dark neutral black transverse band on interorbital, 1 above hind half of pectoral, 1 at soft dorsal base and 1 on caudal peduncle Larger example with spots smaller and more numerous Caudal dusky terminally Anal whitish, also under surfaec of body Dusky blotch just before pectoral base Length 84 to 180 mm

Delagoa Bay, two specimens

Canthigaster margaritatus (Rüppell)

Depth (contracted) 2, head $2\frac{1}{2}$, width $1\frac{1}{3}$, snout $1\frac{1}{2}$, upper profile slightly concave, eye 5, 3 in snout, $1\frac{3}{4}$ in interorbital, mouth width $5\frac{1}{2}$ in head, interorbital 3, concave medially, gill opening 6. Snout, sides of head above, occiput, predorsal and back with fine asperities, most numerous on upper surface of snout and predorsal D. i, 9, first branched ray $2\frac{3}{5}$ in head, A i, 7, second branched ray $3\frac{1}{3}$, caudal $1\frac{3}{5}$, convex behind, P ii, 15, fin $2\frac{1}{2}$ Back dark gray, below gray to whitish Dark gray horizontal streaks about eye, 3 touch in front and 4 behind Sides of head and trunk, and most of caudal, with close set rounded grayish to whitish spots, each with gray bordering ring. Blackish ocellus, nearly large as eye, below dorsal base Teeth white Length 85 mm.

Bluff T. Wall, Natal.

Approaches Bleeker's figure of *Psilonotus margaritatus*, but differs a little in that there are at least 3 distinct horizontal gray continuous lines below the eye, though the whole lower side of the head and breast is with gray dots

Tetrodon stellatus Schneider

Depth 2⅓, head 2⅞, width 1⅗, snout 2, eye 6¼, 3⅗ in snout, 3⅛ in interorbital, mouth width 4⅕ in head, interorbital 2, broadly concave, gill opening 4 Body largely covered with minute asperities, most numerous and close set on occiput and anterior predorsal D i, 9, i, fin 2⅗ in head, A i, 9, i, inserted behind dorsal, fin 2⅕, caudal 1⅞, convex behind, caudal peduncle depth 3, P i, 16, fin 3 "Pinkish brown, with spots larger on belly and behind pectorals" Sides with numerous, small, close-set dusky neutral spots, also extend over caudal where larger basally Length 300 mm

Durban Bay

Tetrodon honckenii Bloch

Depth 3, head 3⅕, width 1, snout 2⅓, from snout tip, eye 4, 1½ in snout, 1¾ in interorbital, mouth width 3⅛ in head, interorbital 2⅞, broadly level or but slightly concave medianly, gill opening 3⅛. Body largely covered with fine prickles, largest on occiput and belly, caudal peduncle, body between dorsal and anal, check and chin, smooth D i, 9, i, fin 1¾ in head, A i, 7, i, begins little behind dorsal origin, fin 1⅞, caudal 1⅗, convex behind, caudal peduncle depth 3¼, P i, 13, fin 1⅗ Neutral dusky above, lower border sharply contrasted from whitish below Above with many brown blotches, mostly oblong Blackish oblique line from infraorbital back and downward, parallel with gill opening Pectoral axil blackish, adjacent color above bordering gill opening broadly pale or whitish Dorsal dusky basally, pale terminally Caudal reversed. Anal whitish. Pectoral pale. Mandible dull dusky Length 128 mm

Umgazi River, Natal, in 20 fathoms

DIODONTIDAE

Diodon hystrix *Linné*

Depth (inflated) 1¼, head 2⅕, snout 3, length ⅓ width, eye 4½ in head, mouth width 3¼, interorbital 1⅗, very slightly concave Spines slender, fine, longest on postpectoral region D. 13, but little less than caudal, A 10, half of caudal, caudal 2⅓, P 24, fin 2¼ Gray brown above, white below Irregular neutral black blotches sparsely over back, more numerous and smaller over sides Fins pale. Length 47 mm.

Natal

Chilomycterus orbicularis (Bloch)

Depth 1⅗, head 2⅔, width 1, snout 2⅘, eye 3⅗, 1⅞ in interorbital, mouth width 3¼ in head, teeth rather small, little inclined from horizontal, shallow, interorbital 1⅞, slightly concave Gill opening 1⅓ in eye Spines strong, 9 rows between snout and dorsal fin, 3 short spines on each suborbital, short frontal spine, tail spineless, with roots of single pair reaching across behind dorsal fin D. i, 10, base entirely before anal, $2\frac{1}{5}$ in head, A I, 9, fin $3\frac{2}{5}$, caudal $1\frac{1}{5}$, pectoral II, 17, fin 2 Back drab gray, below pale. On sides each spine in pale or whitish area, and blackish clouding on middle of back and down sides Fins grayish, clouded little darker Length 148 mm

Tugela River, in 60 fathoms

LOPHIIDAE

Chirolophius insidiator Regan

Depth $4\frac{1}{5}$, head $1\frac{2}{10}$, width $1\frac{2}{5}$, snout 3, from snout tip, eye 7, 2 in snout, equals interorbital, maxillary 2 in head, to eye center, expansion 2 in eye, teeth triserial in jaws, row of small ones on each maxillary and row of large ones on each palatine, interorbital deeply concave, with bony flange above each eye, width $6\frac{1}{5}$ in head Skin soft, tender D VI—8, first spine 3 in total head length, ends in filamentous flap $1\frac{1}{5}$ in snout and depressed little beyond eye, soft dorsal origin at last third in combined head and body length, first ray $3\frac{2}{5}$ in total head length, A. 6, I, origin little behind dorsal origin, third ray $3\frac{2}{5}$, P 15, fifth ray $3\frac{1}{5}$, V 3, C. 2 Neutral gray, little paler below Each side of tongue gray, mottled with dull brown. Length 106 mm.

Natal coast, in 40 fathoms

THE GENUS ALLOPHYTON OF SOUTHERN MEXICO AND GUATEMALA

BY FRANCIS W PENNELL

It appears that the generic name *Tetranema* Bentham, long held for a small but very natural group of Scrophulariaceous plants from southern Mexico and Guatemala, is a homonym by reason of an older, definitely typifiable, *Tetranema* Sweet, pertaining to another family The occasion of assigning another name to the plants of Bentham's genus may well be used for reviewing the present status of our knowledge concerning them

The original species of *Tetranema* Bentham was described in 1843, and the only additional species which has ever been added to this genus was described in 1889 No other genus has ever been reduced to the synonymy of *Tetranema* Bentham, so that there are no submerged names which might now be raised and applied instead of *Tetranema* The characters of *Tetranema* were so peculiarly distinctive that, until 1914, no related genus had been proposed which could possibly prove congeneric But in that year appeared *Allophyton* Brandegee, and, after careful comparison of specimens, I am convinced that no fundamental feature separates this genus from *Tetranema* Bentham Consequently, the name *Allophyton* may be assigned to the combined genus Brandegee has added a most remarkable third species to the two known before

The original species of this genus had been known in gardens before 1843 as a *Penstemon*, and to that genus Bentham considered his *Tetranema* to be closely allied Writing in DeCandolle's "Prodromus" in 1846, he distinguished the new genus by two features the absence of the characteristically developed sterile filament of *Penstemon* and the loculicidal dehiscence of the capsule Doubtless, he also realized the profound difference in habit All the species of *Allophyton* have short stems that are densely crowded with long, or surprisingly long, obovate leaves, while their flowers occur in close clusters borne on long peduncles The habit throughout suggests plants of the Gesneriaceae rather than of the Scrophulariaceae Probably the most crucial of these points of contrast with *Penstemon* is the loculicidal dehiscence of the capsule, and the plants of the Scrophulariaceae that possess this feature seem mostly sharply removed from those that retain a primitive septicidal dehiscence.

To find natural relatives for *Allophyton* is beyond the projected scope of this paper The possibility of a distant kinship with *Russelia* may be suggested That genus has a closely similar flower and the dehiscence of its capsule is likewise loculicidal But the differences are also considerable Neither leaves nor inflorescence of *Russelia* suggest *Allophyton*, while the peculiar capsules, densely stuffed with tortuous hairs, present a feature that is unique in the Scrophulariaceae In common with *Russelia* however, and in contrast with the Nearctic *Penstemon*, is the Neotropical dispersal of *Allophyton* Growing in tropical or subtropical forest, an environment unusual for Scrophulariaceae, both *Russelia* and *Allophyton* are genera peculiarly isolated structurally as well as geographically

There are few specimens of *Allophyton* in herbaria In the course of this study most of the specimens preserved in this country have been examined, and I am indebted to Prof. B L Robinson of the Gray Herbarium of Harvard University, Dr N L Britton of the New York Botanical Garden, Mr W R Maxon of the United States National Herbarium, and Prof W L Jepson of the University of California, for the loan of specimens in their care These herbaria are denoted in the citations of exsiccatae by H, Y, U, and C, respectively Even with such aid one finds represented but five localities for the three species The flora of the forests of southern Mexico and Central America is poorly known as yet, and the prediction may be ventured that a number of additional species of *Allophyton* will some day be discovered

ALLOPHYTON Brandegee

Tetranema Benth , in Bot Reg. pl 52 1843 Genotype, *T mexicanum* Benth. Not *Tetranema* Sweet, 1830, of the Papilionaceae.

Allophyton Brandegee, in Univ Calif Publ. Bot 6 62 1914. Genotype, *A megaphyllum* Brandegee

Suffrutescent herbs, the stem perennial and somewhat ligneous, ascending or erect, short, 1 dm. long or less Leaves opposite, numerous, crowded, the blades obovate and elongate, narrowed to a sessile or slightly clasping base, crenate-dentate to entire, conspicuously reticulate beneath Inflorescences axillary, consisting of long-peduncled, simple, or compound cymes of pediceled flowers, pedicels slender, much shorter than the peduncle, each pedicel subtended by an inconspicuous linear bract Sepals narrow, attenuate-acuminate Corolla campanulate, glabrous throughout, purple and spotted or mottled within (at least in *A mexicanum*); lobes shorter than the tube, all somewhat spreading, the two posterior lobes united nearly to apex Stamens four, didynamous Style slender Stigma capitate, somewhat bilobate Capsule ovate in outline, glabrous Seeds (seen only in *A mexicanum*) tetrahedral, angled, dark brown, with close dense testa that is apparently minutely reticulate or foveolate

TABLE OF SPECIES

Stamens included Style 7–10 mm long Corolla 13–15 mm long Capsule 4–5 mm long Leaves 15–20 cm long, the blades acute or obtuse, the finer reticulations beneath scarcely evident Primary branches of cyme usually bearing only a single flower

- Peduncles much shorter than the leaves, mostly 6–7 cm long Pedicels glabrous, three or four, mostly 10 20 mm long, so forming a lax few-flowered cluster Style 10 mm long Leaf-blades relatively thin, green beneath, the margins sinuate-crenate and ciliate *A evolutum*
- Peduncles nearly as long as the leaves, mostly 12–17 cm long Pedicels brown-pubescent, usually ten or more, 5–10 mm long, so forming a dense many-flowered cluster Style 7–9 mm long. Leaf-blades thick, pale beneath, the margins crenate to crenate-dentate, not ciliate *A mexicanum*

Stamens exserted Style 30 mm long Corolla 22–28 mm long Capsule 8–10 mm long Leaves 20–35 cm long, the blades acuminate, the finer reticulations beneath forming an evident close network Primary branches of cyme mostly bearing secondary or even tertiary flower-clusters Peduncles 10–15 cm long Pedicels 15–30 mm long, the cyme very lax Leaf-blades relatively thin, green beneath *A megaphyllum*

Allophyton evolutum (Donnell-Smith) Pennell, comb nov

> *Tetranema evolutum* Donnell-Smith, in Bot Gaz 14 29 1889 "On rocks, Pansamalá [Guatemala], alt 3,800 feet, May, 1887 (Ex Pl cit ,(1,218) " Isotypes, Pansamalá, Depart Alta Verapaz, collected by H von Tuerckheim, seen in herbaria Academy of Natural Sciences of Philadelphia, Gray Herbarium of Harvard University, and Columbia College at the New York Botanical Garden

Rocky places, northern Guatemala, at 1140 meters altitude Flowering in May. Known only from the original collection

Allophyton mexicanum (Benth.) Pennell, comb nov

> *Tetranema mexicanum* Benth , Lindl , in Bot Reg pl 52 1843 "[The name Pentstemon mexicanus, Hort] has possibly originated in Belgium, whence [i e. whither] the plant seems to have been introduced, as is said, from Mexico In a wild state it is unknown to me " Three years later Bentham, writing in DC , Prod 10 331, 1846, knew the plant from near Vera Cruz, Galeotti 1905 and Linden 443 Probably the original seeds for garden cultivation came from one of these cited collections

"Damp steep rocks," probably in forest of the lower mountain slopes, central and northern Vera Cruz. Flowering in January and March Seen from Chiquihuite, Vallée de Cordova, Bourgeau 2127 (H), Mirador, Liebmann 9343 (U), and Barranca de Tenampa, Zacuapan, Purpus 2945 (H, U, Y) and 5748 (H, U, Y)

Allophyton megaphyllum Brandegee

> *Allophyton megaphyllum* Brandegee in Univ Calif Publ Bot 6 62 1914 "Collected at Finca Irlanda [Chiapas], growing in moist soil of damp barrancas [Purpus] No 6855 Type, Herb Univ Calif, No 172562" Type, collected Sept, 1913, seen in Herb University of California.

Moist damp barrancas or wooded canyons, probably in forest of the lower mountain slopes, Chiapas Flowering in June and September Known only from the original locality, Purpus 6855 (C) and 7213 (C, H, Y)

ANATOMY OF HENDERSONIA: A PRIMITIVE HELICINID MOLLUSK

BY H BURRINGTON BAKER

Our knowledge of the internal anatomy of the Helicinidae (Gastropoda Rhipidoglossa) begins with Isenkrahe's[1] study of *Schasicheila* (*Emoda*) *titanica* (Poey) Later von Ihering[2] dissected the nervous system of *Sturanya beryllina* (Gould) and Bouvier[3] those of *Helicina* (*Angulata*) *brasiliensis* Gray and *Schasicheila* (*Emoda*) *sagraiana* (Orb), Thiele (1902)[4] added a few details of the male genitalia of *Hendersonia* (*Waldemaria*) *japonica* (A Adams) and the female organs (1910)[5] of *Pleuropoma* (*?*) *kubaryi* (authority and locality?), and Bourne (1911)[6] presented the first comprehensive anatomy from his studies on *Oligyra* (*Alcadia*) *palliata* (C B Adams) and *hollandi* (C B A), *Pleuropoma andamanica* (Benson), *P merguiensis* (Pfr), *P rogersii* (Bourne), *P* (*Sphaeroconia*) *gouldiana* (Forbes), *Orobophana* (*?*) *pachystoma ponsonbyi* (Smith), *Ceratopoma idae* (Pfr), *Lucidella aureola* (Fér) and *Eutrochatella pulchella* (Gray) However, these descriptions, with the exception of Thiele's first notes, deal with the more specialized members of the family

On the other hand, *Hendersonia occulta rubella* (Green)[7] has been considered by Wagner (1907–1911)[8] and myself,[9] on the basis of its paucispiral operculum and its radula,[10] to be the most primitive living example of the family (i e, the most primitive terrestrial mollusk) outside of the little-known genus *Bourciera* from Ecuador The typical subspecies (Say)[11] occurs as a recent fossil and probably had a rather wide distribution in temperate United States, but the more angulate modern subspecies is only known from a few widely separated localities The genus *Hendersonia* includes other species in Japan and China

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[1] 1867, Arch Naturg XXXIII, 50–72, taf I

[2] 1877, Vergl Anat Nervensyst u Phylog Moll

[3] 1887, Ann Sci Nat (7) III, 1–510, pls I–XIX, also 1886, Bull Soc Phil Paris (7) X, 93–97 and 1892, Compt Rend Ac Paris, CXIV, 1281–1283

[4] 1902, Zeit wiss Zool LXXII, 249–466, taf XVIII–XXVII

[5] 1910, Abh Senck Naturf Ges XXXII, 351–358, taf XXV

[6] 1911, Proc Zool Soc London, 759–809, pls. XXX–XLII

[7] 1832, Cabinet of Natural History, II, 291

[8] 1907–1911, Conch. Cab v Mart Chemn, Neue Folge Die Familie der Helicinidae.

[9] 1922, Proc Acad Nat Sci Philadelphia, LXXIV, 29–67, pls III–VII.

[10] First described by Bland and Binney, 1871, Amer Jour Conch VII, 29–30, pl II–6

[11] 1831, Transylvania Jour Medicine, IV, 1528

My specimens were collected April 30th, 1925, from limestone talus at the base of the cliffs which support the physiographic monstrosity that gives its name to Natural Bridge, Virginia The dissections were made and figured, mainly from drowned material preserved in 60% alcohol, at the Marine Biological Laboratory in Woods Hole and at the Zoölogical Laboratory of the University of Pennsylvania Especial thanks are due Dr Eleanor Carothers for six sets of serial sections, on account of the small size of this species, these were of great assistance in the determination of anatomical details, and all descriptions of tissues are based on them The best fixation was obtained by flooding the living animal with B_3 plus chromic acid, which also dissolves the calcareous material of the shell The sections were stained with Alum Cochineal and counterstained with Orange G

EXTERNAL FORM AND INTEGUMENT

(Plate VII, figs 1, 2, 6, plate VIII, figs 8, 9, 11)

In most terrestrial operculates, the females are notably larger than the males (Cf H B B , 1924)[12], so many authors (Cf Wagner, 1910),[13] including myself, have taken it for granted that a similar difference occurs between the sexes in the Helicinidae In *Hendersonia*, however, observation leads me to believe that the males average larger than do the females, although the sexes intergrade very much in size and the statistical results, given below, are negative

In order to preserve the material in good condition, most of the shells were chipped away from the animals immediately after drowning, but 21 specimens were left intact As I was expecting some difference in size between the sexes, I selected the smallest and the largest individuals for careful preservation, so this residuum does not represent a random series These 21 shells were measured and then the animals were dissected to determine the sex The resultant figures appear to indicate a slightly larger size for the females, but the numbers are too small to give a basis for any accurate statement

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[12] 1924, Occ P Mus. Zool Univ Mich , no 152, 1–158, pls. I–XXI.

[13] 1910, Abh Senck Naturf Ges. XXXII, 181–186, taf XVI

	Altitude	Major Diameter	Minor Diameter	Whorls
Females (6 specimens)				
Means	5 5	140 (7 7)	123 (6 8)	5¾
Extremes	5 3-5 7	137-142 (7 5-8 1)	118-128 (6 3-7 1)	5¼-6
Males (15 specimens)				
Means	5 4	137 (7 4)	125 (6 7)	5½
Extremes	5 0-5 6	132-143 (7 1-7 7)	118-130 (6 4-7 0)	5-6

The whitish sole of the foot (Plate VII, fig 1, F) is from 5 to 6 times as long as broad, its sides are almost parallel and the posterior end is bluntly rounded At the anterior end and for a short distance down the sides, a deep groove separates a thin fold, the mentum (Fm), near the median line, at the bottom of this groove is the external opening of the duct from the pedal mucous gland (Fg) The sides of the animal outside of the shell are usually darkly pigmented although lighter individuals also occur The lateral portions of the foot and the dorsum of the dorsoventrally flattened posterior end are coarsely reticulate

Separated from the foot and mentum by a deep groove is the small snout or rostrum with the diamond-shaped mouth (M) near the center of its transversely oval ventrum, which is marked by a distinct median groove and another fainter one that bisects the lateral angles of the mouth The cephalic tentacles are quite long and slender when extended, the sessile eyes are on the dorsolateral sides of their bases (Cf Isenkrahe, fig. I-2). At the lateral edges of the groove between the rostrum and mentum are small lobes which project ventrad

The surface of the body is covered by a simple, non-ciliate, columnar epithelium which usually contains some goblet cells This layer is especially thick on the sole (Plate VIII, fig 11), where it develops a distinct, continuous cuticle and practically lacks the goblet-cells. These last are especially numerous in the epidermis on the sides of the foot The epithelium is lowest and stains most deeply over the portion of the mantle which lines the shell

The horny, paucispiral operculum (Cf Wagner, 1907, fig I-2) is borne on an opercular disc just behind the mantle edge Anteriad to this is a heavy, complexly-folded ridge which overlaps the groove from which the major portion of the operculum develops The spindle muscle is attached to a rather narrow, sigmoid zone near the columellar (anterior) margin The entire surface of the opercular disc is covered by a simple columnar epithelium which, inside of the anterior groove (Plate VIII, fig 9), is underlain by a zone with large cells in the meshes of the fibrous reticulum These underlying cells have small nuclei, are crowded with globules which stain yellowish, and appear to assist in the secretion of the horny layer which forms the growing edge of the operculum The calcareous portion of the latter consists mainly of scattered granules on its outer surface

The whitish mantle edge is complete, that is, it completely surrounds the base of the visceral mass Anteriad and laterad, it is free, very broad and thick, and contains numerous blood sinuses (Plate VIII, fig 8), posteriad, it forms a thin fold which is often reflected upward and away from the adjacent opercular ridge

At the base of, and posterior to, the thinner, posterior portion of the mantle edge are the openings of two accessory opercular organs, one on each side The left or columellar organ (Plate VII, fig 4, plate VIII, fig 8, Z), which lies dorsomediad to the base of, and extends into, the left columellar muscle, consists of a complexly-lobed sac, which is apparently connected by a pore with a second, two-chambered organ The lobed sac (Bourne, fig XL–55, gl d) is lined by simple columnar epithelium with rather large cells which appear swollen by large, clear vacuoles so that the small nuclei are pressed against the walls A squamous basement epithelium surrounds this portion of the gland The basal chamber of the adjacent organ (Plate VIII, fig 8, Z) is lined by a single layer of cuboid cells with large nuclei and is surrounded by a somewhat thicker layer of dense connective tissue The upper chamber is very thin-walled and flattened, it comes into close contact with the walls of the pedal and oesophageal blood-sinuses Between these two chambers, the cavity (Bourne, fig XL–55, sac) is constricted by a pronounced thickening of the walls of the organ, the connective tissue that forms this constriction is very dense, contains hyaline cells and closely resembles fibrous cartilage (car , fig cited) The cuboid epithelium of this narrowed lumen is similar to that of the basal sac but is ciliated The organ on the right (sutural) side is similar in structure to the lobed sac but is smaller and simpler, the double-chambered organ is absent.

As the columella of the shell and the partitions of all except the last whorl are progressively dissolved away as the animal increases in size, the visceral mass is a flattened spheroid that is just encircled by the flattened cylindrical last whorl of the animal.

Ventrally, a conical, slightly-twisted outgrowth from the visceral mass fills the columellar cavity above the thin umbilical callus The left and right columellar muscles (Plate VII, fig 6, C and R) lie respectively in the basal and parietal angles of the last whorl, have a flattened enlargement at their inner ends, and are attached to the inside of the shell just beyond the edge of the remaining portion of the partition (i e , just inside of the major shell cavity) The mantle over the last whorl is usually darkly pigmented in the males and spotted in the females, in addition, the lower prostate of the secondary gonaduct appears pink in preserved males while the entire duct is light yellowish in the females

The Pallial Complex

(Plate VII, figs 3 to 7, plate VIII, figs 8, 10, plate X, fig 22)

In order to simplify the following discussion of the pallial complex, the left columellar muscle will be considered as the sinistral edge of the pallial cavity and the right columellar as the dextral edge Also, the free border of the mantle will be regarded as the anterior end and the kidney as posterior in relative position In the same manner, the side towards the oesophageal sinus (Plate VII, fig 6, 0) and diaphragm will be described as the ventrum, that towards the hindgut (I) as the dorsum In the description of the visceral mass, the terms apical, basal and peripheral will be used

The large pallial cavity or lung (L, plate VII, figs 6, 7 and plate VIII, fig 8) extends from the broad muscular, anterior portion of the mantle edge (Le) to a point some distance behind the inner end of the last whorl and the attachments of the columellar muscles to the shell Along its dorsal wall (i e , the upper palatal surface of the last whorl) lies the last limb of the hindgut (I), with the secondary gonaduct (T) attached to its anterior ⅔ and the hypobranchial gland (H) to its posterior ⅓ Ventrally (i e , just outside of the basal angle), the small oesophageal sinus (0) is separated from it by the thin but muscular diaphragm Its main respiratory surface (L fig. 7) lies between the hindgut and the left columellar muscle (i e , along the lower palatal wall of the last whorl), but a narrow area extends between the right columellar muscle (R) and the oesophageal sinus (i e , along the parietal wall), and the diaphragm probably also permits the passage of gases The groove between the secondary gonaduct and the right columellar muscle represents the right branchial region, at its apex, opposite the posterior end of the secondary gonaduct, is the external opening of the hypobranchial gland (Po, fig 7) which, in the female, surrounds the provaginal orifice The anal (Io) and secondary gonaducal (To) openings are a short distance inside of the mantle edge, and the (left) external ureteric opening (Uo) is near the posterior end of the main respiratory surface

At its anterior edge, (and for some distance back in the female), the pallial cavity is lined by a relatively high, simple columnar epithelium (Plate VIII, figs 8, 10) with numerous large goblet or mucous cells, especially on the surface of the lung near the genitalia Most of the epithelial surface in the male and a major portion in the female is much lower, the columellar cells decrease in size and the goblet cells become less conspicuous towards the posterior or inner end

At this point, a brief discussion of gastropod asymmetry in relation to that of *Hendersonia* may not be out of place Most authors (Cf Huxley,[14] Lankester,[15] et al) seem to correlate this with a tendency towards elongation or increase in size of the visceral mass If this bulky outgrowth should fall forward (Lang)[16] or coil exogastricly (Pelseneer)[17], it would produce pressure on the sense organs If it should fall backward or coil endogastricly, it would tend to squeeze the pallial organs Comprising, it tends to fall laterally or to coil in a dextral spiral, which puts pressure on one side and tends to push the anus and pallial complex in a counterclockwise direction Whether the primitive gastropod actually passed through a stage with a vertical or dextral visceral cone (Lang) or developed an exogastric shell (Pelseneer) seems doubtful, probably the dextrally spiral shell came into existence simultaneously with the more rapid growth of the left side of the animal, as advocated by Bütschli[18] and Plate [19] In any case, the corresponding torsional forces are present and tend to produce an anterodextral position of the anus and pallial cavity, a subintestinal position of the left visceral ganglion, and a relative reduction of the organs on the right side of the visceral mass and on the primitively left side of the pallial complex (secondarily right in prosobranchs) Simultaneously with these torsional processes or more probably somewhat later, an increase in the length of the mantle cavity has tended to push posteriad and dorsad the anal, excretory and genital openings, this is often compensated by an increase in length of the hindgut and the parallel development of a secondary gonaduct This dorsoposteriad extension of the pallial complex tends to force the right visceral ganglion over the oesophagus and to increase the necessity for a reduction of the right (primitively left) pallial organs

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[14] 1853, Phil Trans R. S London, CXLIII, 29–65, pls I–IV
[15] 1883, Encycl Brit, 9th ed, XVI, 632–695
[16] 1894, Lehrb verg Anat wirbellosen Th, Kap VII, Mollusca, XIV
[17] 1906, Lankester's A Treatise of Zoology, part V
[18] 1887, Morph Jahrb XII, 202–222, pls XI–XII
[19] 1895, Zool Jahrb Abth Anat IX, 162–206

Thus, *Hendersonia* (Plate VII, figs 3, 4, 6, 7) has lost practically all of the right (prosobranch) portion of the pallial roof, so that the hindgut and secondary gonaduct are closely approximated to the right columellar muscle However, this genus does retain a vestigial right (prosobranch) auricle (Ar) and also a metamorphosed right kidney (the copulatory or provaginal apparatus), which in the female opens (Po) on the right side of the intestine In these features, *Hendersonia* appears to be fully as primitive as the Neritidae (Cf Simroth[20] and Bourne, 1908,[21] for discussion and literature).

But, coincident with its adaptation to a terrestrial existence, the (left prosobranch) pallial roof has greatly increased in relative length so as to form most of the large lung As the basal or columellar edge of this (left) pallial region (fig 7, L) is shorter than the sutural or parietal edge (i e, the left columellar muscle is shorter than the right one), most of this elongation seems to have taken place on its dextral side This has carried the (left) external ureteric opening (Uo) backward so that it lies far behind the (right) provaginal opening (Po) and even some distance behind the base of the (left) kidney (K), the long axis of which is almost at right angles to that of the pallial cavity In addition, the hindgut has been lengthened and thrown into a loop towards the left, so that the apex of the ventricle (V), which is closely associated with the hindgut (fig 4), although no longer traversed by it, points almost anteriad, that is, the right (prosobranch) auricle (Ar) is sinistral and the left (A) dextral in relative position This rotation of the heart through nearly 180° has been accompanied by a transference of the long axis of the (left) kidney through about 270°

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[20] 1896–1907, Bronn's Klass. Ord Tier III–II, Gastropoda prosobranchia
[21] 1908, Proc Zool Soc London, 810–887, pls. XLVI–LXVI

and an elongation of the ureter (U), which now runs along the dorsal surface of the kidney (fig 4) at right angles to the terminal limb of the hindgut

The principal pulmonary vessels are the afferent pallial or rectal vessel (La) along the left side of the secondary gonaduct (T) and hindgut (I), the (left) pulmonary vena cava (Lv) on the right of the left columellar muscle (C) and the right pulmonary or palliorenal portal vein (Kp) between the gonaduct and the right columellar muscle (R) Apparently, the blood passes from the visceral sinus into the afferent pallial (La) and then across the roof of the lung to the pulmonary vena cava (Lv), and also from the oesophageal sinus (O) across the narrower respiratory surface to the palliorenal portal (Kp) No prominent transverse venation is visible on the surface of the lung, but the sections show numerous small sinuses In addition, a series of large bloodspaces (Plate VIII, fig 8) in the anterior border of the mantle connect the palliorenal portal and pulmonary veins

The heart lies along the obliquely truncate left side of the posterior end of the pallial cavity, although its morphologically longitudinal axis is almost parallel (at 180°) to that of the pallial cavity, the much greater development of the functional (left prosobranch but dextral) auricle (fig 4, A) has established an actual long axis at about 135° to that of the lung The large pulmonary vena cava (Lv) enters the pericardium near its actual anterior end and passes along its wall to enter the anterior side of the functional auricle (A) which is recurved so as to lie almost parallel to this principal tributary This functional auricle has slightly glandular walls somewhat similar to those in *Theodoxus* (Lenssen[22], 1902, fig II–26), in addition to the large pulmonary vena cava, it receives a number of short ventral renal veins from the adjacent walls of the kidney and a dorsal renal (Kv) that curves around posteriad to the apical half of the ureter, crosses dorsad to the latter and enters the heart opposite the vena cava The vestigial (right prosobranch but sinistral) auricle (Ar) is a small fusiform sac which lies in a dorsal space between the base of the kidney, the shorter limb of the hindgut and the external mantle epithelium (E, fig 3), it receives no large blood-vessels The muscular-walled ventricle (V) is elongated in the direction of the functional auricle but has a conical pocket on the side towards the vestigial one;

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[22] 1902, La Cellule, XX, 289–333, pls. I–III

its walls are in close contact with those of the short limb of the hindgut The principal aorta (Va) arises from the ventral side (fig 7) of the ventricular apex and almost immediately divides into a small visceral aorta and a larger cephalic one, the last runs along the intestine towards the head and foot

The blood is collected by a series of communicating sinuses, of which the principal ones are the visceral in the apical mass, the oesophageal (O, fig 6) already described, the cephalic around the buccal mass and nerve ring, and the pedal (Fs, fig 8) above the nerve-cords in the foot From these, the blood can return to the heart through at least three systems 1, the renal portal, 2, the palliorenal portal, and 3, the principal pulmonary The renal portals are a number of short channels that pass directly from the visceral sinus into the blood-spaces of the ventral side of the kidney and thence through the short ventral renal veins into the functional auricle The path of the blood from the oesophageal sinus to the palliorenal portal and the connection between the latter and the vena cava have already been described, the posterior end of this palliorenal passes to the greater curvature of the kidney, where the blood can pass through anastamosing sinuses into the dorsal renal vein The principal pulmonary system is the one between the afferent pallial and the vena cava across the most extensive respiratory surface

The pericardium consists of a large, oval cavity which surrounds the ventricle, the functional auricle and the base of the vena cava and also of a smaller conical pocket that encloses the vestigial auricle and its connection with the ventricle It lies just under the mantle on the exterior of the visceral mass in the lesser curvature of the kidney, which it slightly overlaps Its lining is a very thin, simple squamous mesothelium Near its dextroposterior end, it communicates with the lumen of the kidney apex by a very short and narrow, renopericardial canal (X, figs. 3, 4), which is lined by a single layer of ciliated, cuboid cells (Plate VII, fig 5)

The functional excretory organ or (left) kidney (K, figs 3, 4, 7) is a flattened, crescentic organ which lies inside of the loop of the hindgut All around its outer margin (i e , its greater curvature), it overlaps the hindgut, in addition, its left or basal half gives off an internal lamina, so that, in this region, it almost completely surrounds the hindgut (fig 3) The rather thick but quite simple walls consist of a single layer of large columnar cells (fig 5) with enlarged luminal ends, prominent basal nuclei and extremely vacuolate cytoplasm, which stains a brilliant orange The only trabecula of any size is a flattened development of the anterior wall which extends a short distance into the ventral lamina The ureter (U) opens out of the basal or left end of the kidney and curves around the posterior end of the pericardium, so as to lie on the dorsal side of the excretory organ for the entire length of the latter Towards its base, this excretory duct becomes enlarged and finally opens by a small orifice (Uo) through a prominent papilla just above the apex (right end) of the kidney near the posterior end of the pallial cavity The ureteric lining is a simple, thick squamous to subcuboid, epitheloid layer, while the external ureteric papilla is covered with high, mucous cells

The hypobranchial or mantle gland (H, figs 3, 7 and plate X, fig 22) does not differ markedly from those described by Thiele (1902) and Bourne (1911) for other Helicinidae It opens into the posterior end of the right pallial groove by a short, wide duct (Ho, Po), which also includes the provaginal orifice and passes externad to the primary gonaduct (Gd) Attention is called to the fact that its position is practically that of the albuminiparous gland of most pulmonates, in the female, it would still communicate with the fertilization chamber through the provaginal canal if its connection with the mantle cavity were closed Haller's[23] (1894, 95) demonstration that similar glands in *Cemoria noachina* (Fissurellidae) do secrete the egg envelopes is at least interesting in this connection

THE DIGESTIVE SYSTEM

(Plate VII, figs 3, 4, 6, 7; pl VIII, figs 8, 10, 12, pl IX, figs 14, 18, pl X, fig 22)

The buccal mass (Plate VIII, fig 12, Mc, Mo) is relatively elongate and slender Anteriad, it contains the small, ovoid buccal cavity or pharynx (Mc) while the major portion is formed by the odontophoral apparatus (Mo) and the oesophageal vestibule (Ov) which overlies this Posteriad, from between the radular cartilages, the slender radular pouch (Mp) extends into the oesophageal sinus for a distance equal to ¾ the length of the mass itself.

The pharynx extends only a short distance under the odontophoral apparatus, i e , the subradular pouch is very slightly developed

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[23] 1894, Studien über Docoglose und Rhipidoglosse Prosobranchier

The oesophageal vestibule (Ov) is a roughly conical, although dorsoventrally flattened chamber which is continuous with the pharynx through a large opening above the anterior end of the radula Posteriad, it gives off, on either side, a large, digitiform, basally swollen, oesophageal sac (Op) and is continued by the slender oesophagus proper (O) As compared with *Oligyra palliata* (Bourne, 1911, XXX, figs 2–4), the oesophageal vestibule appears much longer and the pharynx seems to envelop the anterior ends of the cartilages to a lesser extent, but I suspect a part of this difference is caused by the greater protraction of the odontophoral cartilages in my specimens

The anterior part of the pharynx is lined by a simple columnar, cuticulate epithelium much like that of the foot Towards the oesophageal vestibule, the epithelium becomes higher and ciliate, in addition, large, ovoid, goblet cells, filled with glairy material, become more and more evident The oesophageal sacs are similarly lined although the goblet or mucous cells again diminish in prominence In three separate areas on each side, the epithelium is considerably thickened and almost entirely consists of mucous cells The most anterior pair of these forms the *buccal patches* (Bourne, glandular walls of diverticulum), each of which is simply a region, near a lateral edge of the posterior floor of the buccal cavity just under the anterior ends of the radular cartilages, where the elongated goblet cells predominate and the ciliate cells occur only as attenuate columns between them On the other hand, the middle and posterior pairs have much thicker walls which bulge outward to form shallow trenches or crypts, somewhat the shape of half a coffee-seed, the middle or *buccal crypts* (Mg, fig 12) are on the dorsal side of the junction between the pharynx and oesophageal vestibule, while the posterior or *oesophageal crypts* are on the ventral side of the junction between the oesophageal vestibule and the bases of its lateral sacs The last pair have been described and figured for *Theodoxus fluviatilis* by Lenssen[24] (1899, figs. I–13, 14), in both, the principal lining of the walls consists of a layer of elongate, ciliate, columnar cells with basal nuclei and a thicker external stratum of irregularly arranged, subspherical cells Both types of cells are usually filled with a glairy, mucous secretion which resembles that of the pedal gland

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[24] 1899, La Cellule, XVI, 179–232, pls. I–IV.

(Fg, fig 8) or that in the salivary glands of pulmonates The homologies of these buccal patches and these two pairs of salivary glands are, of course, unknown, but the middle or buccal crypts (Bourne, salivary glands) seems to agree in position with the openings of the salivary ducts in many gastropods

The radular cartilages agree quite closely with four principal ones of *Oligyra palliata* (Bourne, fig XXXI-5), their structure (Cf Lenssen, 1899, fig I-7) is certainly very different from that in pulmonates (H B B, 1925, figs XIV-22, 27)[25] The anterior half of the radula lies folded in the groove formed by their dorsomedian concavities and extends over the V-shaped surface between their anterior ends As discussed in another paper (H B B, 1923, 126),[26] the teeth of the central field of the radula of *Hendersonia* (H B B, 1922, fig III-1) appear actually more primitive than those in the Neritidae, while the laterals (op cit, fig IV-10) are specialized along divergent lines The radular pouch is lined by a simple squamous epithelium which becomes higher (cuboid) on its roof and towards the posterior, free end The muscles of the odontophoral apparatus are very complex, but a number of the more prominent and distinct bands can be quite easily traced As practically all of these are paired, only those of one side will be described

The *retractors of the buccal mass* are comparatively superficial The *dorsal members*, which must act also as elevators, can be divided into an anterior and a posterior set on each side The posterior set consists of two heavy roots, which arise from the dorsal body wall just above the base of the oesophageal sacs of the same side, pass respectively inside and outside of the ventral tensor-protractor, and insert as a common head on the fascia of the lateral sides of the anterior cartilages This head sends a small slip ventroanteriad to insert on the sides of the rostrum; this portion must act as an elevator of the snout In front of the posterior set are two minute strands with similar origin and insertion to the larger bands The *anterior dorsal retractor* arises from the body wall above the buccal crypts and inserts on the walls of the buccal cavity, this muscle must also act as an elevator of the snout. In addition, a very slender *ventral retractor* arises from the ventral body wall, runs between the cerebropedal and cerebropleural connectives of the same side, and inserts on the fascia over the anterior ends of the larger cartilages All of these are assisted by a broad fan of *rostral retractors*, which arise from the ventral body wall and insert around the anterior end of the buccal walls and mouth Finally, a slender *elevator* arises from the origin of the larger posterior dorsal retractor and inserts near the base of the outer side of the posterior cartilage of the same side.

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[25] 1925, Proc Cal Acad Sci (4) XIV, 143-169, pls XI-XIV

[26] 1923, Proc Acad Nat Sci Philadelphia, LXXV, 117-178, pls. IX-XVI.

The *protractors of the cartilages* are more distinctly attached to these structures themselves The *ventral protractor* arises from the wall of the snout just inside of the cerebral ganglion and inserts quite high on the exterior face of the corresponding posterior cartilage The large *ventral tensor-protractor* arises on the side of the buccal pouch and inserts on the side of a posterior cartilage A somewhat smaller *ventral tensor* arises near the dorsal side of the anterior tip of each larger cartilage and inserts on the ventral side of the corresponding posterior cartilage. The small *dorsal protractor* arises from the body wall above the buccal crypts and inserts on the lateral side of the posterior cartilage, while a *dorsal tensor-protractor* has its origin on the side of the oesophageal vestibule just behind the buccal crypt and inserts on the dorsal side of the tip of the posterior cartilage

The anterior cartilages are bound together ventrally by two sets of transverse fibers. The *superficial constrictor-sheath* is a squarish band of muscle that is attached at either end high on the sides of the buccal pouch and the anterior ends of the large cartilages, it passes ventrad to these structures so as to sheathe the anterior ends of the tensor-protractors, the tensors and the radular protractors The *ventral sheet of cross-fibers* (Herrick)[27] passes from the lateral side of the base of one anterior cartilage to the same position on the other, so as to close the bottom of the anterior portion of the radular trough The posterior cartilages are not bound to each other by any large muscle outside of the radular retractors. The dorsal sheet of cross-fibers and the sets of criss-cross fibers described for *Fulgur canaliculatus* (Herrick) appear to be undeveloped

The muscles which protract the radula are three in number on each side. The *extrinsic protractor* is a very slender band which arises from the transverse fibers behind the ventral ganglia of the nerve-ring, passes through the pleuropedal ring and inserts on the anterior end of the intrinsic protractor, it must also act as a retractor of the buccal mass and probably represents Haller's (1894, fig XI–129, s) "nerve" to the subradular organ The *intrinsic protractor* is a much larger muscle band with its origin on the ventral side of the posterior cartilage and its insertion on the anterior recurved end of the radular membrane, it runs parallel with the cartilage tensor The third *protractor* is that *of the radular pouch;* it is a very small band that arises on the base of the oesophageal vestibule, about half-way between the oesophageal and buccal crypts, and inserts on the side of the radular pouch a short distance behind the posterior cartilage

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[27] 1906, Amer. Nat XL, 707–737

The *radular retractors* form a dorsal and a ventral set on each side The *dorsal group* consists of numerous strands which arise from a triangular area with its apex near the middle of the dorsolateral edge of the anterior cartilage and its base somewhat more than the dorsal half of the lateral side and end of the posterior one, the almost parallel fibers pass obliquely forward over the dorsal border of the cartilages to insert on the side of the anterior half (or a little less) of the radular membrane The *ventral set* is a fan-shaped group of strands that arise as a broad band over the median half of the posterior end of the smaller cartilage, this splits into numerous, divergent strips which insert along the ventral and lateral sides of the radular ribbon The insertion of the ventral set corresponds to about the posterior half of that of the dorsal set In addition, a small, unpaired *retractor of the radular pouch* connects the posterior end of the latter with the ventral wall of the oesophageal sinus

As indicated in the foregoing account, the protractors and retractors of the cartilages are mainly long, slender ribbons, while the radular retractors are comparatively short and broad This would appear to permit considerable movement of the entire buccal mass, together with a short, but very powerful rasp of the radula alone The relative amount of movement between the parts of the system may be contrasted with the extensive radular but comparatively slight cartilage action in *Fulgur canaliculatus* (Herrick, 1906).

The very long and slender oesophagus (O, fig 12) extends through the oesophageal sinus (O, fig 6) to the posterior end of the pallial cavity, then along the ventrum of the stomach, slightly towards the right side, and finally enters near the fundic end of the latter (Sf, fig 12) between the hepatic ducts (Dr) Its walls are longitudinally folded and are fundamentally similar to those of *Theodoxus fluviatilis* (Lenssen, 1899, figs I–13, 14) It is accompanied by the cephalic aorta which sends branches along the suspensory ligaments to the posterior tips of the oesophageal sacs

The stomach (Sf, Si, fig 12, Cf Bourne, fig XXXI–7) is a very large, gourd-shaped sac which fills a large portion of the visceral mass (S, fig 3) In general, its long axis is almost continuous with that of the mantle cavity and at right angles to the overlying kidney and pericardium, but its right side is somewhat smaller than its left and the entire structure is curved ventrad at both ends The interior is marked off by folds into three, poorly-separated compartments 1, the fundic, 2, the superior intestinal or glandular, and 3, the inferior intestinal or pyloric (Cf Lenssen, 1899, figs II–19, 20) The fundic compartment is large, ovoid and mainly thin-walled, but, on the ventrum, two low, ciliate, internal folds bound a shallow groove (gouttière oesophagienne of Lenssen) which forms a continuation of the oesophageal channel These folds are continuous with the thickenings which surround the enormous apertures of the right (Dr) and left hepatic lobes Also continuous with the right fold (instead of the left as in *Theodoxus*) is a large, ovoid, transversely-folded thickening, which apparently represents the "crête stomacale" (Lenssen, fig II–26). The anterior or intestinal end of the stomach is curved anteriad over the oesophagus, and tapers gradually to pass imperceptibly into the intestine Ventrally (i e , next the oesophagus), a wide, internal thickening of the wall extends from the opening of the oesophagus into the intestine Along the left side, another, similar but higher and narrower, internal thickening limits a ventrosinistral or intestinal compartment (gouttière pylorique of Lenssen) and a dorsodextral, thick-walled, superior intestinal region The inferior intestinal compartment is continuous with the fundic at one end and the intestine at the other, its weak, longitudinal folds divide and radiate irregularly over the fundic wall The superior intestinal region (Lenssen; fig 19, str) has transverse ridges throughout its length, but is weakly demarcated from the fundic region by the most posteriad and highest of the series It does not develop a caecum like that of *Theodoxus* (Lenssen, fig. 19, cu).

The stomach is lined by simple columnar epithelium which becomes pseudostratified in some of the higher thickenings As Lenssen (1899, figs 27, 28) has pointed out for *Theodoxus*, the luminal surface of this epithelium seems to show every gradation from cilia, through heavier projections and striate cuticle to a solid or granular cuticulum Mainly, the strictly ciliated portions are limited to the thickenings along the oesophageal groove and the two principal ridges in the intestinal end The epithelium of the fundic and inferior intestinal compartments is mainly low and the wall is thin, but the superior intestinal portion has numerous ridges of large cells The highest and most slender cells occur in the principal thickenings, those in the "crête" are the extremes of this type, although, unlike at least some of those in the other ridges, they develop a very thick cuticle (Cf Bourne, p 771)

The liver or hepatic-pancreatic gland consists of a right and a considerably larger left lobe, both are relatively small and simple pouches with large lumina which communicate with that of the stomach through the large openings already mentioned (Dr, fig 12) Each is subdivided into a small number of large, comparatively thin-walled lobules that are imbedded around the stomach and extend into the umbilical protuberance of the visceral mass The epithelium of these lobules contains both liver and chalk cells and, in fact is quite similar to that in the pulmonates (H B B, 1925, fig XII-13), although, at first glance, the very large lumina of the lobules give the tissue, as a whole, a very different appearance

From the anterior end of the stomach, the intestine curves sharply backward and passes around the right side of the oesophagus so as to form a short suboesophageal loop to the left, but returns again to cross a second time above the gullet, and then bends backward along the left side of the stomach, just outside of the fold that separates the superior and inferior intestinal compartments of that organ Near the line of demarcation between the superior and fundic compartments, it leaves the side of the stomach to appear on the surface of the visceral mass, where it becomes pigmented These intestinal loops are comparatively simple and so are somewhat similar to those of *Lucidella aureola* (Bourne, fig XXXII-14). From this point, it loops around the posterior end of the pallial cavity, passing close to the ventricle of the heart, external to the left portion of the kidney and between the external and internal right lobes (figs. 3, 4, 7), and then turns anteriad to form the elongate limb along the hypobranchial gland and secondary gonaduct. In the male (Plate X, fig 22), the anal opening (Io) is a short distance inside of the pallial cavity, internad to that of the gonaduct and a little behind it In the female (Plate IX, figs 14, 18), the anus turns sharply to the left and opens inside the little hood (Io) which partially surrounds the ovipository orifice.

The initial, suboesophageal loop of the intestine is simply a narrowed continuation of the stomach and retains the ventral, ciliate thickening and simple columnar epithelium of the inferior intestinal compartment Near where it crosses above the oesophagus for the second time, the ciliated thickening disappears and the remainder of the epithelium becomes lower (cuboid), until it reaches the condition in the thin-walled hindgut, which is lined by a simple squamous epithelium with a few, irregularly-scattered groups of higher, ciliate cells The terminal hood of the female is lined by a very high, richly ciliate epithelium, with numerous mucous cells which are similar to but even larger than those of the mantle edge (fig 10)

THE FEMALE GENITALIA

(Plate VII, fig 7, plate IX, figs 14 to 21)

The group of digitiform to ovoid lobules that compose the ovary (fig 14) extends across the base of the visceral mass with an enlargement near the head of the oviduct and a smaller one in the umbilical lobe Each lobule is lined by a layer of squamous cells and closely packed with a mass of large oögonia Near the outer edge is a variable zone of less developed oögonia and irregularly flattened, smaller cells, some of these last also lie between the central egg cells These lobules converge towards a spherical enlargement of the primary oviduct (G1), this egg sac, in my material (Cf Bourne, p 778), is filled with what appear to be primary oöcytes together with loosened interstitial cells from the lobules

Opening out of the egg sac is a slender, rather short tube (G2), lined by cuboid epithelium with very long cilia This duct enlarges rather abruptly into what Bourne (l c) calls the descending limb of the V-shaped portion of the oviduct (G3, figs 14, 15); the latter is lined by high, pseudostratified, columnar epithelium with shorter cilia and brownish cytoplasm that contains numerous hyaline globules. Just beyond the apex of the V, this is enlarged to form a trilobate pocket, the accessory sperm sac (Gb), which is lined by very similar epithelium, in my material, the lumen of this pocket is crowded with spermatozoa Anteriad from the accessory sperm sac, the "ascending limb" of the oviduct gradually enlarges into a radially folded fertilization chamber (G4), which is lined by cells similar in form to those of the descending limb but with still shorter cilia and comparatively homogeneous cytoplasm which stains a bright purple (Plate IX, fig 20) In my material, this chamber contains a few scattered spermatozoa; it forms the last chamber of what I consider the primary gonaduct As discussed below, probably a portion of the latter is derived from the common renopericardial-gonadic duct of the more primitive Rhipidoglossa and the Neritidae, but the absence of any connection with the pericardium prevents its identification in the adult Helicinid

Near the base of the fertilization chamber, a very short connecting duct leads into a little *provagina* or copulatory (?) chamber (Plate IX, fig 16, Pv), that also receives the narrowed ends of the spermatheca (B, figs 14, 16) and provaginal sac (P, figs 14, 15, 16) and opens (Po) by another short channel into the mantle cavity through the basal portion of the hypobranchial duct All of these spaces are lined by a low, simple columnar epithelium with large nuclei The provaginal orifice is surrounded by a papilla that is composed of large ovoid cells, each with a swollen vacuole, a large basal nucleus and purple-stained cytoplasm

The spermatheca or bursa copulatrix is a comparatively small, deeply lobed sac that lies against the side of the fertilization chamber towards the lung, it is lined by cells which are similar to those of the provagina but somewhat higher (Cf Bourne, fig XXXVII-39), on their outer ends, these develop numerous cytoplasmic processes that appear too stout to be cilia In my material, this sac is crowded with spermatozoa which are arranged radially so that their heads lie between or on the cytoplasmic processes just mentioned. Bourne terms this organ the caecum, and appears to consider it as a new structure developed in the Helicinidae alone, in my judgment, its connections and position certainly identify it, instead of the accessory sperm sac, with what he terms the receptaculum seminalis in the Neritidae (see Table I) As indicated above, it opens into the provagina in *Hendersonia* as in *Oligyra hollandi* (Bourne, fig. XXXV-25), although it appears to be quite separate in some of the other Helicinidae (op. cit, figs 28-29).

TABLE I FEMALE GENITALIA

Approximate Homologies	Neritidae (Bourne	*Theodoxus* (Gilson)[33]	Helicinidae (Bourne)	*Hendersonia*
Gonad	ovary	ovary	ovary	ovary
Right renopericardial canal	oviducocoelomic funnel	absent	absent	absent
Primary gonaduct	oviduct (above oviducocoelomic funnel)	oviduct	oviduct with 1st limb V	primary oviduct, egg sac, narrow and enlarged portions
Common renopericardial-gonadic duct	end of oviduct and thalamus, egg-duct	fertilization chamber and première ampoule (Lenss.)	2nd limb V, receptaculum seminalis	fertilization chamber and accessory sperm sac
	vaginal canal	connecting duct	vaginal canal	connecting duct
Right kidney	receptaculum seminalis	spermatheca	caecum	spermatheca
	sperm sac	bursa	vaginal sac	provaginal sac
Right ureter	vagina	vagina	vagina	provagina
Right nephrostome	vaginal aperture	intromittent orifice	vaginal aperture	provaginal orifice
Secondary gonaduct	oötype	glandular and incubatory oviduct	oötype	uterus (Lenssen)
	crystal sac	uterus		

The provaginal or copulatory (?) sac is a comparatively thin-walled, somewhat irregular sac which is imbedded between the fertilization chamber and the exterior of the mantle, its wall (Plate IX, fig 19) is formed by a single layer of columnar cells with irregularly-swollen luminal ends, rather large nuclei and cytoplasm which stains brownish This epithelium somewhat resembles that which lines the (left) kidney

In the Neritidae, Thiele (1902) has homologized the provaginal apparatus and spermatheca with the right (primitively left) kidney of the lower Rhipidoglossa, and I am inclined to accept this origin for these structures in the Helicinidae as well Bourne (1908, p 873) has objected to this hypothesis on the basis of his discovery of a gonadic coelome and oviduco-coelomic funnel near the ovary in certain Neritidae, he claims that the kidney should be above (behind) this opening instead of below it However, as both Pelseneer (1896)[29] and Simroth (1896–1907) have pointed out, the primary gonaduct and the renopericardial canal of most Rhipidoglossa either unite before entrance into the right kidney or enter it in close juxtaposition As shown by my tables (I and II), I am of the same opinion as Thiele and believe that Bourne has simply proved that, in the Neritidae at least, a large portion of what is termed here the primary gonaduct is actually derived from the common renopericardial-gonadic tube From the presence of sperm in the provaginal sac, spermatheca, accessory sperm sac and fertilization chamber and their absence from the uterus, it seems probable that the provaginal orifice receives the male products in *Hendersonia occulta*, although this may not be the case in *Oligyra hollandi* (Bourne, 1911, p 779)

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[33] 1896, Proc. Mal Soc. London, II, 81-83.

The large secondary oviduct or uterus (T, Plate IX, figs 14–18) is a stout tube which tapers gradually from just below the base of the fertilization chamber to the ovipository (?) opening The thick wall of its posterior end is thrown up into coarse convolutions and mainly consists of a high pseudostratified, columnar epithelium The very long, slender cells (Plate IX, fig 21) that uniformly compose this layer have small nuclei and are densely packed with hyaline globules that stain orange or even brown Towards its anterior end, the wall becomes somewhat thinner and simpler, especially on the side towards the hindgut, but is composed of very similar, although considerably shorter cells In my specimens, the external opening always projects beyond the anal hood (Io, figs 14, 18) that surrounds this end of the organ. The uterus is remarkable for the uniformity of its structure and apparently is almost completely without ciliate cells

THE MALE GENITALIA

(Plate VII, fig 6; plate X, figs 22–29)

The testis (Plate X, fig. 22, G) is an irregularly oval mass of quite large lobules, which are imbedded in the base of the visceral mass and in the umbilical outgrowth Each lobule is bounded by a very thin layer of simple squamous epithelium and is packed with large germ-cells, most of which are about the same size (apparently spermatids in my material). Large nurse-cells, like those of the pulmonates, appear to be absent, and the alveoli are so crowded that the lumina are reduced to narrow channels which contain spermatozoa in various stages of development These channels converge to enter the primary sperm-duct (Gd), which is coiled back and forth between the base of the testis and the hypobranchial gland (H) so as to form a sort of epididymis, these stout convolutions and the testis taken together occupy about the same region of the male as that taken up by the ovary alone in the female In my material, this portion is greatly swollen by masses of maturing spermatozoa (Cf Thiele, 1902, fig XXVI-135, ds), which are usually parallel to each other but are not definitely oriented in respect to the enclosing wall The epididymis tapers abruptly to become the short slender portion of the sperm-duct, the walls of the swollen portion are formed by a single layer of low, almost squamous cells, which become cuboid towards the lower end and finally pass into the elongate (densely staining, purple), ciliate cells with basal nuclei that are characteristic of the slender portion The last opens through an egg-shaped papilla (Plate X, fig 23, Gd) into a thin-walled, conical prolongation of the apical chamber of the secondary gonaduct, a ciliate epithelium, similar to but even higher than that of the duct, covers this papilla and extends as a pilaster up into the basal portion of the provaginal sac (P).

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[29] 1896, Zool Anz. XIX, 140–145.

Imbedded between the posterior end of the secondary gonaduct (T1) and the base of the hypobranchial gland is an elongate-ovoid, very weakly-lobed sac (P, figs 22–25), which is lined by a single layer of cells that stain a dark brown, develop low and irregular, internal folds composed of higher cells, and closely resemble those which line the provaginal sac of the female (Plate IX, fig 19) In the male, this provaginal sac empties into the first prostate (T1, figs 22–25) near the papilla of the sperm-duct, its lumen approaches but does not connect with the mantle-cavity, although the epithelium of the latter develops a thickening composed of large vacuolate cells which resemble very closely those of the provaginal papilla in the female The function of this male provaginal sac is dubious, but I have little doubt that it is homologous with that of the female and represents the metamorphosed right kidney (See table II) It is probably absent in most Helicinidae and is certainly not the second diverticulum of Bourne (1911, p 786)

TABLE II MALE GENITALIA

Approximate Homologies	Neritidae (Bourne)	*Theodoxus* (Lenssen)	Helicinidae (Bourne)	*Hendersonia*
Gonad	testis	testicule	testis	testis
Primary gonaduct and right renopericardial-gonadic duct	epididymis and sperm-duct	canal déférent	sperm-duct	epididymis and sperm-duct, opening of provaginal sac
Right kidney	absent	absent	absent	provaginal sac
Right nephrostome	absent	absent	absent	closed papilla
Secondary gonaduct	thalamus and prostate terminal chamber	poche semilunaire	terminal sac	first prostate second prostate, terminal chamber and papilla
	basal glands	glande annexe	1st and 2nd diverticula	accessory prostate and caecum

The secondary sperm-duct is divided into four rather distinctly demarcated chambers: 1, the apical chamber or first prostate (T1, plate X), 2, the middle portion or second prostate (T2), 3, the terminal chamber (T3), and 4, the diverticulum or accessory prostate (Td) All of these chambers are lined by a pseudostratified, columnar epithelium, in which three general types of cells can be differentiated The ciliate or non-glandular type (Cf plate IX, fig 20) consists of comparatively low cells with clear or light purplish (stained) cytoplasm and comparatively large, basal or central nuclei (i. e , pseudostratified so as to give the appearance of two layers) A modification of this class develops considerably more elongate cells with numerous colorless globules. A further increase in glandular function seems to result in the yellow (stained) glandular cells, which have the cytoplasm packed with globules which stain yellow or golden, and are somewhat similar to those of the uterus of the female (Plate IX, fig 21), although usually less elongate and more vacuolate Every gradation between these first two types can be found, especially in the upper part of the terminal chamber The third or purple (stained) glandular (mucous?) type (Plate X, fig 29) only occurs in the walls of the first prostate, these cells are fusiform to long ovate in shape with basal nuclei and are swollen by masses of glandular material which stains a deep purple or a very dark red They are commonly shorter than the cells around them and appear to develop externally and then move towards the lumen in order to discharge their secretions. Toward the periphery of all of the epithelia, shorter interstitial cells appear to represent the undeveloped reserves

The posterior chamber or first prostate forms a little more than ¼ the length and is the broadest region of the secondary gonaduct The wall on its left side is quite thin, as is that of the conical pocket into which empty the sperm-duct and provaginal sac, but, on its right side, an enormous, complexly lobed pilaster (Plate X, figs 23–25) usually restricts the lumen to a narrow slit This principal cavity is lined by elongate cells which stain a brilliant yellow, although many in the left wall appear longitudinally fibrillate and largely lack prominent globules (fig 29), these are interspersed with the purple glandular ones mentioned above The pilaster consists of numerous, very complexly folded lobules whose narrow lumina are continuations of the principal cavity, each lobule is lined by a single layer of swollen cells similar to those of the yellow glandular type but usually with very large, clear vacuoles The constriction which separates the first and second prostates is lined by cells of the ciliate type which stain a bright purple similar to those of the fertilization chamber of the female (fig 20)

The middle portion or second prostate is about half the length of the entire secondary gonaduct and tapers in width from its posterior end against the first prostate to where it passes gradually into the third chamber. Its thick walls (T2, figs 26, 27) are mainly composed of the yellow glandular cells, which are elongated locally to form a weak pilaster along its pallial side and irregularly transverse ridges elsewhere Towards the diverticulum is a rather sharply demarcated, longitudinal zone of much lower, ciliate cells; this becomes indefinite and diffuse towards its apical end Anteriad, this zone becomes thicker and many of the cells develop colorless granules, this initiates a longitudinal ridge which becomes considerably higher in the next region

The anterior fourth of the secondary gonaduct constitutes the terminal chamber which tapers gradually towards the thick-lipped external opening At its posterior end, this division bifurcates to pass gradually into the second prostate on the left side and the accessory prostate on the right, from the angle between these, a prominent conical papilla (Tp, plate VII, fig 6), which is continuous with the ridge in the anterior portion of the second prostate, almost fills the lumen for some distance The comparatively thin and simple wall of this terminal chamber (fig 28) consists mainly of the ciliated type of cells, although some of these are more elongate and contain colorless globules, while the higher epithelium which composes the papilla contains numerous vacuolate cells which approach the yellow glandular type

The accessory prostate or diverticulum is a slightly flattened tube which is almost as long as the first and second prostatic chambers combined and lies along their right sides In the basal portion, the epithelial cells are ciliate and may be more or less undifferentiated or contain colorless globules, but soon (Td, fig 27), two quite distinct regions are apparent 1, a pilaster composed of slender, light yellowish but ciliate cells along the left (interstitial) side, and 2, a thin-walled region with lower epithelium of the strictly ciliate type About 2 mm above the base, the side towards the external mantle begins to develop cells of the yellow glandular type with densely-staining, almost brown globules and practically no vacuoles Passing upwards, these rapidly become more numerous until the clearer, ciliated cells are restricted to the side towards the pallial cavity and second prostate Here the accessory prostate gives off a small digitiform caecum (Tc, figs 22, 26), which only contains the clearer, ciliate type of epithelium; the diverticulum proper above this point (i e, for a little over half of its length) is lined entirely by the highly developed, brownish-stained, glandular cells, which increase in height until the apical blind end is almost solid (Td, figs. 24–26) The diverticular caecum may be homologous with the much longer second diverticulum of *Lucidella aureola* and *Eutrochatella pulchella* (Bourne, p 785, fig XXXVII-42) which opens into the terminal chamber opposite the orifice of the accessory prostate In any case, the presence of the provaginal sac in male individuals of *Hendersonia* shows conclusively that all of the secondary gonaduct (with its diverticula) is homologous with the uterus of the female.

Hendersonia has no structure that would appear to function as a penis, although the terminal chamber of the secondary gonaduct is surrounded by loose connective tissue which may permit some evagination, it scarcely seems capable of function as a copulatory organ for reaching the provaginal orifice of the female, high in the mantle cavity Considering the anatomy of the two sexes, the only plausible method of copula would seem to be approximation of the two mantle openings In this position, the hypobranchial glands, the goblet cells inside of the pallial cavity of the female, or the enormous prostates of the male, may be able to flood the lung of the female to an extent that would enable the sperm to travel up the groove between the uterus and right columellar muscle to the provaginal or "copulatory" opening The relatively large size of the males does permit the production of enormous numbers of spermatozoa and may compensate in part for this apparently inefficient method of internal fertilization

In the field, I picked up two specimens which were held together in some way, but these separated before I was able to determine what was happening No copulation was observed in specimens kept several months in captivity As all of the adult females examined had sperm in the various seminal receptacles, the actual transference of these probably took place early in the spring

THE NERVOUS SYSTEM

Plate VIII, figs 8 and 13

The nervous system is very similar to that of *Oligyra palliata* (Bourne, figs XXXIX-43, 44) The large cerebral ganglia are on either side of the anterior end of the buccal mass and are connected by a rather long, stout, cerebral commissure and a slender labial or subcerebral one (6, fig 13) Each ganglion has two lobes (Cf. Bouvier, 1887, figs. III-10, 11), the large, roughly triangular cerebral one gives off the tentacular (1) and optic (2) nerves, the cerebral commissure and the quite long (cerebro-) pleural and (cerebro-) pedal connectives, while the smaller, ventromedian labial lobe is the origin for the two anterior (3) and two posterior (4) labials, a nerve to the side of the rostrum (5), the labial commissure (6) and the (cerebro-) buccal or stomatogastric connective The buccal connectives arise from the dorsal side of each labial lobe, run between the buccal mass and certain of its protractors, and join the transversely ovoid buccal ganglia (Cf Bouvier, fig. II–9), which lie in close proximity to each other between the origin of the oesophagus and the base of the radular apparatus Each of these ganglia give off two anterodorsal nerves (7) to the dorsal and ventral sides of the pharynx and oesophagus and a medioposterior one (8) towards the radular cartilage of the same side; in addition, a median, unpaired nerve runs back along the radular pouch

The pleural, pedal and subintestinal (left visceral) ganglia are all closely approximated (Cf Bouvier, fig III–12), in fact, the pleuropedal and left (pleuro-) visceral connectives, the pedal commissure and the right zygoconnective are all very stout and have an external layer of ganglion cells just as do the ganglia themselves The left pleural ganglion is slightly smaller than the right one, besides the connectives, each gives off an anterior pallial nerve (9), which bifurcates before it enters the body wall, and a very large palliocolumellar trunk (10) that divides at the body wall into a large columellar (11) and a smaller posterior pallial (12)

The supraintestinal (right visceral) ganglion and connective appear to be entirely absent The subintestinal (left visceral) ganglion is simply a slight enlargement at the base of the large connective (13) to the abdominal ganglion, all along this very long abdominal connective (13) occur some ganglion-cells, although they only form a continuous external layer in the portion near the left pleural center This peculiar arrangement seems to be due to a gradual concentration of the individual nerve-cells rather than to a shortening of the connective between the left pleural and subintestinal ganglia; in *Nerita ornata*, Haller (1894, fig XI–129) has figured a condition in which the subintestinal connective appears to have two ganglionic concentrations, one near the left pleural as in the Helicinidae and the other in the usual position of a subintestinal ganglion As already indicated, right zygoneury is well developed, in fact, the stout zygoconnective actually passes between the right and left pleural ganglia through the base of the subintestinal

The triradiate abdominal ganglion lies at the base of the visceral mass under the oesophagus and the coils of the intestine. It gives off a nerve to the stomach (14, Cf. Bourne, fig XXXIX–43, V_2)

along the posterior end of the abdominal connective, a posterior one to the visceral mass (15, Cf Bourne, connection with V G$_2$), a right posterior one to the genitalia (16, Cf Bourne, n gen), and a right anterior one to the right side of the visceral mass (17, Cf Bourne, V_1), the last appears to anastamose with the right posterior pallial (12) along the right edge of the diaphragm but I can not trace any similar connection on the left side

The pedal cords (Fn, fig 8, 18, fig 13) extend to very near the posterior end of the foot, although their anterior ends are definitely enlarged into pedal ganglia, each of which gives off two anterior pedal nerves (19) Near the middle of the length, their centers are separated by about ¼ the width of the foot, but they are so large that their interspace is only about 1⅓ times the width of either of them, towards their posterior ends, their centers remain about the same distance apart but each cord diminishes greatly in diameter Two definite transverse strands connect their anterior ends a short distance behind the principal pedal commissure, but the other anastamoses are small and irregular Throughout the posterior portion of their length, they lie immediately below the pedal sinus (Fs, fig 8), but in the anterior region they are surrounded by the pedal gland (Fg) The otocysts (Y, fig 8, 20, fig 13) lie on the dorsal side of the pedal ganglia near the posterior ends of the latter, and the acoustic nerve can be followed anteriad until it joins the pleural connective on its way to the cerebral ganglion.

CONCLUSIONS

1 *Hendersonia* retains a right (prosobranch) auricle and a metamorphosed right kidney (provaginal apparatus) in both sexes, and thus apparently represents a more primitive condition than that indicated by previous workers for other Helicinidae

2 As regards the first of these characters, *Hendersonia* is fully as generalized as any known Neritid, while, in the second, it appears even less specialized Also, in the uncinate form of the third lateral of the radula and in the posterior position of both external ureteric openings, most Helicinidae share this more primitive organization For these reasons, the Neritidae can not be considered as in any sense ancestral to the Helicinidae.

3 On the other hand, the marine and freshwater habitats of most Neritidae have permitted them to retain certain markedly primitive characters, while the terrestrial life of the Helicinidae

can be correlated with an increase in specialization along several lines, all of which center around the notable elongation of the dorsal region (Bourne, 1911, p 764) and pallial cavity, coincident with the conversion of the latter into a lung In this last category of Helicinid characters fall the rotation of the heart and kidney, the comparative freedom of the ventricle from the looped hindgut, the separation of the pericardium and the right kidney (provaginal apparatus), the apparently complete reduction of the supraintestinal ganglion and its connectives, and the relative elongation of the hindgut, the secondary gonaduct, the oesophagus and the nerve strand between the subintestinal and abdominal ganglia

4 While the homologies between the Rhipidoglossa and the Pulmonata are still extremely hypothetical, the genitalia of *Hendersonia* and the Helicinidae perhaps can be tentatively regarded as representative of an intermediate stage between those of the less specialized members of the former group and those of the latter Thus it seems plausible to consider that the primary gonaduct of *Hendersonia* may correspond to the ovisperm duct of the Pulmonata, that its secondary gonaduct may be roughly homologous with the spermoviduct, and that the spermathecae of both groups may correspond to some development of the right kidney In addition, the derivation of the albumen gland of the pulmonates from the hypobranchial gland of the Rhipidoglossa has already been indicated as a possible interpretation

5 In addition, both the Helicinidae and the Pulmonata show a marked tendency towards the concentration of the cerebral, pleural and, to some extent, the pedal ganglia But the latter group tends to shorten the visceral ring so as to approximate the subintestinal and abdominal ganglia as well, this "detorsion" process produces the euthyneurous condition Euthyneury is very different from the false "orthoneury" of the Helicinidae, which apparently is the result of an elongation of the subintestinal connective, a gradual pleurad concentration of its ganglionic elements, and the reduction of the supraintestinal chain. Thus, the nervous systems of these two pulmonate groups actually prove the more usual conception of separate evolutions from common, probably marine, ancestors

Description of Plates VII–X

All drawings are made with aid of camera lucida. With the exception of fig. 2, those of systems and organs are made from dissections of drowned (i. e., partially extended) animals, while fig. 2 and those of transverse sections and histological details are made from stained slides (i. e., more retracted specimens). The cells are drawn as somewhat idealized, quite thin, optical sections, the lumen of the gland or organ is uppermost unless specifically stated otherwise. The scales for these figures of cells represent 50 microns, those for the others, one millimeter. The following symbols are used except in fig. 13.

A	functional (left prosobranch) auricle
Ar	vestigial (right prosobranch) auricle
B	spermatheca or bursa copulatrix
C	left columellar muscle.
D	digestive gland or liver
Dr	cut end of right hepatic duct
E.	exterior epithelium
F	foot
Fg	pedal gland and duct
Fm	mentum
Fn	pedal nerve cords
Fs	pedal blood sinus
G	gonad (ovary or testis)
Gb	accessory sperm sac (female)
Gd	primary gonaduct (egg or sperm)
G1	egg sac (female)
G2	narrow oviduct (female)
G3	first limb of V-duct (female)
G4.	fertilization chamber (female)
H	hypobranchial gland
Ho	hypobranchial orifice
I	intestine or hindgut
Io	anus or intestinal hood (female)
K	functional (left) kidney
Kp	palliorenal portal vein
Kv	dorsal renal vein
L	lung or pallial cavity
La.	afferent pallial vessel
Le	anterior mantle edge
Lv	pulmonary vena cava
M	mouth
Mc	buccal cavity and pharynx
Mg	buccal salivary crypts
Mo	odontophoral bulb
Mp	radular pouch
O	oesophagus
Op	oesophageal sacs.
Ov	oesophageal vestibule
P	provaginal sac
Po	provaginal orifice (inside that of hypobranchial gland)
Pv	provaginal vestibule (provagina)
R.	right columellar muscle
S	stomach
Sf	fundic compartment
Si	intestinal or pyloric region
T	secondary gonaduct or uterus (female)
Tc	caecum of prostatic diverticulum
Td	accessory prostate or diverticulum
To	external opening.
Tp	papilla of terminal chamber (male)
T1	first prostate (male)
T2	second prostate (male)
T3	terminal chamber (male)
U	functional (left) ureter
Uo	external ureteric orifice
V	ventricle
Va	aortae
X	renopericardial pore
Y	otocyst
Z	opercular organ (basal chamber of accessory sac)

PLATE VII.—Foot and Pallial Complex. Each scale in lower right hand corner of plate represents one millimeter, uppermost is for fig. 1, second for fig. 7, third for fig. 4, fourth for figs. 3, 6, lowest for fig. 2. Scale, representing 50 microns, for fig. 5 is under its numeral.

Fig. 1.—Outlines of sole and rostrum (M) from ventral side. Dotted lines show relative proportions of pedal gland (Fg) and its duct.

Fig. 2.—Reconstruction of left opercular organ, made from serial sections of a female. Outlines of lumina of accessory sac (at right) are represented by dotted lines.

Fig. 3.—Section through anterior tips of kidney and renopericardial pore (X) of a female. Exterior surface of animal is at bottom of figure.

Fig. 4.—External (dorsal) view of kidney and adjacent organs from a large male, after removal of external mantle and roof of pericardium. Two arrows give approximate plane of fig. 3.

Fig. 5.—Details of epithelium of renopericardial pore (below) and that of kidney (above). Pericardium would be to right of figure.

Fig 6 —Transverse section through last whorl of a male, back about ¼ length of lung from anterior mantle edge, so as to pass through papilla (Tp) of terminal chamber of secondary gonaduct Tip of one oesophageal sac is shown just above oesophagus (O) inside of oesophageal blood sinus.

Fig 7 —Internal (ventral) view of pallial complex of female Roof of lung (L) is cut between right columellar muscle and secondary gonaduct (at Kp of fig 6) and pinned back as flat as possible Hindgut is cut so as to show both enveloping lobes of kidney (K) Pericardium represented as much more transparent than is actually the case

PLATE VIII —Digestive and Nervous Systems, etc Each of upper three scales in lower left hand corner represents one millimeter, uppermost is for fig 12, second for fig 13, third for fig 8 Lowest scale indicates a length of 50 microns and is for figs 9 to 11

Fig 8 —Slightly oblique cross-section through retracted foot, just inside of anterior mantle edge, a portion of latter is omitted The section, from a female, passes through basal chamber of accessory sac of opercular organ (Z), through external opening of principal sac of same, and through tip of intestinal cloaca (Io)

Fig 9 —Detail of lining of opercular groove, epithelium is above and cells with golden globules below

Fig 10 —Epithelial lining of lower portion of mantle cavity from a female, those from intestinal hood would be still larger and ciliate

Fig 11 —Epidermis from sole of foot

Fig 12 —Alimentary tract, mainly viewed from right side, after removal of digestive glands (liver) and odontophoral muscles Coils of intestine are considerably straightened and separated

Fig 13 —Dorsal view of central nervous system with nerves and pedal cords cut Buccal ganglia are pushed anteriad and only its left connective is shown The nerves are labeled as follows

1 tentacular (indicates cerebral ganglion)
2 optic
3 anterior labials (indicate labial lobe of cerebral ganglion)
4 posterior labials
5 rostral
6 labial or subcerebral commissure
7 dorsal and ventral pharyngeals (from buccal ganglion)
8 odontophorals (median and two lateral)
9 right anterior pallial (from right pleural ganglion)
10 left palliocolumellar trunk (from left pleural ganglion)
11 right columellar
12 right posterior pallial
13 abdominal connective (from subintestinal ganglion)
14 gastric (from abdominal ganglion)
15 visceral
16 genital
17 lateral
18 pedal cord and ganglion
19 anterior pedals.
20 otocyst with distal end of acoustic

PLATE IX —Female Genitalia Each scale in lower left hand corner of plate represents one millimeter, uppermost scale is for fig 14, middle one for fig. 15, lowest for figs. 16 to 18 Scale, representing 50 microns, for figs. 19 to 21 is in lower right hand corner

Fig. 14 —Internal (ventral) view of entire genitalia with most of hindgut (I) cut away

Fig 15 —Ventral view of posterior end of uterus and adjacent structures after removal of spermatheca. Primary oviduct is straightened and provaginal sac is dissected out from behind other organs

Fig. 16 —Section through genitalia at provaginal orifice (Po) Broken lines indicate connections (out of plane cut) of provagina (Pv) with its vesicle (P) and spermatheca (B, only base cut)

Fig. 17 —Section through middle portion of secondary gonaduct.

Fig 18 —Section through opening of hindgut (I) into its terminal hood (Io)

Fig. 19 —Three short cells from wall of provaginal sac

Fig 20 —Three cells from lining of fertilization chamber
Fig. 21 —Three cells from wall of upper end of uterus.

PLATE X.—Male Genitalia Each scale in lower right hand corner of plate represents one millimeter, upper one is for fig 22, lower for figs 23 to 28 Scale in lower left hand corner is for fig 29 and indicates a length of 50 microns

Fig 22 —Ventral view of entire genitalia and hypobranchial gland (H), after removal of most of hindgut (I) Tip of accessory prostate (Td) is dissected out from behind first prostatic chamber (T1) and coils of epididymis of primary sperm-duct (Gd) are mainly straightened out

Fig 23 —Section through genitalia at terminal papilla of primary sperm-duct (Gd) Connective tissue between organs omitted in this figure and next five

Fig 24 —Section through genitalia at connecting duct between provaginal sac (P) and lumen of first prostate (T1), actually 13 mm in front of fig 23

Fig 25 —Section through same organs 16 mm. in front of fig 24 Accessory prostate (Td) is cut obliquely

Fig 26 —Section through genitalia at level of diverticular caecum (Tc) Thin-walled, ciliate groove of second prostate (T2) is adjacent to caecum

Fig 27 —Section 83 mm in front of that of fig 26 Thin-walled, ciliate groove is adjacent to accessory prostate (Td)

Fig 28 —Section through terminal chamber near external opening, see fig. 6 for section of same at level of its papilla.

Fig 29 —Four cells, including one of dark-staining type, from wall of first prostate

LAND SNAILS FROM NORTHWESTERN MEXICO

BY HENRY A PILSBRY AND T D A COCKERELL

We are indebted to Mrs Elsie M Chason[1] for two species of *Euglandina*, which she collected recently at Tepic and sent in the living condition They do not seem to agree with any of the described species, and are apparently distinct Other Oleacinidæ, encountered in the course of studying these, have been included here, together with a species of *Polygyra* from Tepic

Many members of this genus are very local in their distribution

Euglandina chasonæ new species Text Fig 4

The shell is fusiform, the last whorl somewhat flattened peripherally, chestnut brown, very glossy, slightly transparent First three whorls are smooth, then riblets appear weakly, these are strongest near the suture above The last whorl is very strongly, but somewhat irregularly ribbed below the slightly crenulate, but not dentate, suture, the ribs rapidly weakening downward, being replaced by two or three times as many little riblets, and below the middle represented by mere ripples Weakly impressed spiral lines cut the riblets into spiral series of oblong granules, but this sculpture is distinctly developed only in the middle region of the space between suture and periphery The aperture is very narrow in the upper part, moderately wide below The columella is evenly, not very strongly, concave, in an oblique view in the aperture from the right side it appears weakly sigmoid The parietal callus is a thin film having a very minute granulation, the granules arranged in lines parallel to the edge of the callus, which thus appears to be striate Length 34 3 mm, diam 14 mm, aperture 18 3 × 7 mm., 6½ whorls

The animal is pale brown, tentacles and labial lobes darker, sole pale gray

Related to *E turris longurio*, which has a longer spire, a more strongly denticulate suture, and is of paler color *E mazatlanica* (von Martens) has no spiral sculpture, among other differences

Type 139942 ANSP

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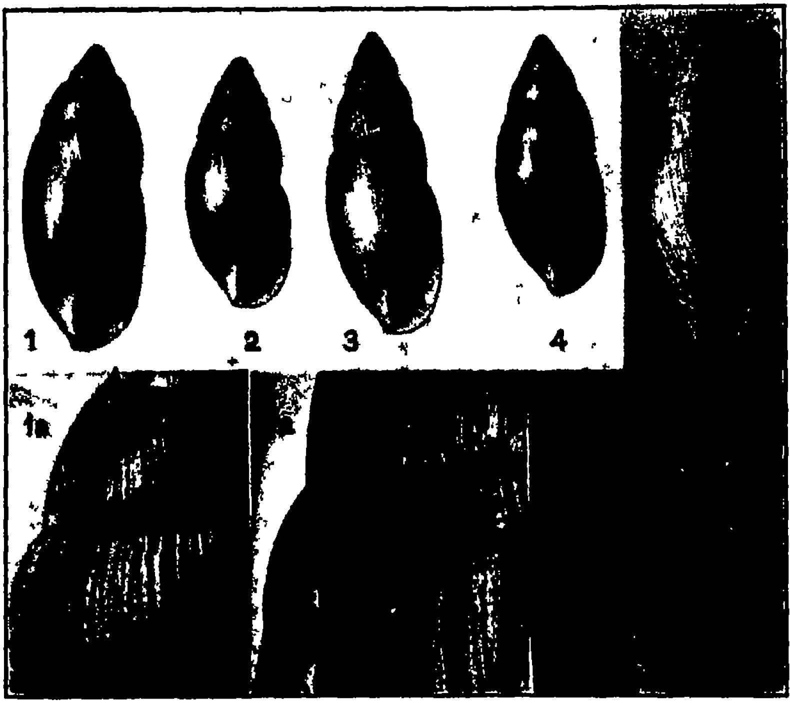
[1] Formerly of the Biology Department of the University of Colorado



Figs 1, 1a —*Euglandina tepicensis* Figs 2, 3, 3a —*E turris longurio*, Guadalajara Fig 4 —*E chasonae* Figs 5, 5a —*E turris longurio*, type, Mazatlan

Euglandina tepicensis n sp Text-Figs 1, 1a

This form differs from *E chasonae* by having the first 2½ whorls smooth, the form stouter, fusiform-oblong, spire shorter, the penult whorl is wider on the left side, as the suture descends more rapidly Aperture narrower in the upper part It is much lighter than *chasonae*, isabella color Sculpture as in *E chasonae* Length 40 3 mm diam 16 3 mm , aperture 22 × 8 mm , 6½ whorls

Animal dark slate color throughout, region just above mouth pallid

Type 139943 ANSP

This species differs from *E albersi* and *E nelsoni* by the possession of distinct spiral sculpture, from *E insignis* by the color, the less strongly developed axial sculpture, scarcely denticulating the suture, and by its brilliant gloss It is also smaller than *E. insignis* The three forms collected by Richardson at Tepic, *E. insignis* (Pfr.), *E albersi* (Pfr), and *E albersi inflata* (Mts), appear to be quite distinct from those obtained by Mrs Chason

The divergence from *E chasonae* in shape and color would not be thought indicative of specific diversity were it not that anatomical differences also were found by one of us (T D A C) In both species the penis-sac is very stout, dumb-bell shape, constricted in the middle, creamy white, with one or more flattened tapering pale gray structures (apparently flagellar in nature, but placed where we look for a retractor muscle) at the end In *E tepicensis* there are two of these apparent flagella, about 5 mm long, and from between these arises the dark gray vas deferens In *E chasonae* there is only one of these structures, and it is about 9 mm long In both the vas deferens, after some distance, is swollen, the swollen part very dark

The penis of *E "truncata"* (*rosea*), as figured by Leidy in Binney's work, is totally different This species belongs to the series without spiral decussating lines The group with such spiral lines, to which our two species belong, is widely distributed, from the north (*E vanuxemensis* Lea) to Guatemala (*E decussata* Deshayes)

The following species of *Euglandina* are now known from northwestern Mexico

E albersi (Pfr), of shorter, more obese figure than other species of the region, has been recorded from Mazatlan, the Tres Marias Islands, Sierra Madra de Colima, and Tepic, Jalisco, those seen by us are from Mazatlan

E nelsoni Bartsch Proc U S Nat Mus vol 37, 1909, p 321, from Acaponeta, Tepic[1] Variable in shape and proportionate length of aperture, the proportions ranging from those of *E albersi* to those of *E mazatlanica* How it differs from these forms was not mentioned

E mazatlanica (v Martens) Mazatlan, Tres Marias Islands A form of the *albersi* type, but more slender

E. excavata (v Martens) Mazatlan? Apparently quite distinct by having the columella spirally twisted below, and thereby differing from all other forms of the region Locality not certain

E insignis (Pfr) San Blas and Tepic, Jalisco[1] The original locality unknown Thought by von Martens to be a race of *E liebmanni*, but this appears doubtful

E pilsbryi Bartsch Proc U S Nat Mus vol 37, p 322, pl 33, f 5, Bolanos, Jalisco

E hererræ (Contreras) Boletin de la Sociedad de Estudios Biologicos, I, May, 1923, p 13, Chapala, Province of Jalisco

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[1] Now Nayarit, by the division of Jalisco

E turris (Pfr) Identified by authors from Mazatlan The type locality of this species was unknown The type specimen, figured by Reeve (Conch Icon , *Achatina,* pl 13, fig 45) differs from numerous specimens of the Mazatlan region in coll. A N S P. as noted below

Euglandina turris longurio new subsp Text-Figs 2, 3, 3*a*, 5, 5*a*

Compared with *E turris*, as figured by Reeve, the aperture is narrower, with the greatest concavity of the inner lip situated lower The columella is straight in our specimens Superficially impressed spiral lines form series of long granules as in figs 3*a*, 5*a*, these vary somewhat in degree of development in different examples, but are always rather weak, though distinct *E turris* was described as "*confertim et leviter costulato-striata,*" without mention of spirals Length 44 3 mm , diam 15 3 mm , length of aperture 20 5 mm width 6 mm , 7½ whorls, the first three smooth

We doubt whether these specimens, which are before us from Mazatlan (Figs 5, 5*a*), Sinaloa, the Tres Marias, and Guadalajara, Jalisco (Figs 2, 3, 3*a*), are specifically identical with the original *E. turris*, but for the present they may be called *Euglandina turris longurio*, the type No 24797 ANSP, from Mazatlan, collected by A Rémond

Salasiella guadalajarensis n sp Text-Fig 6

The shell is cylindric-fusiform, covered with a thin, light yellow periostracum, very lightly marked with lines of growth The spire is conic, apex obtuse, the whorls moderately convex, regularly increasing in width The aperture is two-thirds the length of the shell, extremely narrow in its upper half, the outer lip strongly arching forward Columella very short, rather deeply concave Length 11 7 mm , diam 4 2 mm , length of aperture 7.7 mm , 5½ whorls

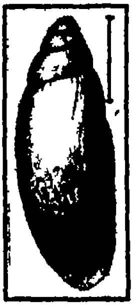

Fig 6 —*Salasiella guadalajarensis*

This form appears nearly related to *S joaquinæ* Strebel, of the environs of Jalapa, Vera Cruz It differs from that species by the narrower aperture, the more obtuse apex and the larger size.

A narrower specimen found with the original lot measures. Length 11 3 mm , diam 3 7 mm ; aperture 6 5 mm long, 5¾ whorls

Guadalajara, Jalisco Type and three others are No 107474 ANSP, collected by R A McConnell and D L. Crawford

Polygyra nayarita new species Text-Fig 7

The shell is quite thin, depressed-subglobose, with moderately elevated spire and deep body whorl which is evenly and broadly rounded peripherally, and descends abruptly in front The umbilicus is narrow, one-sixth the total diameter, being 1 2 mm wide in the last whorl, beyond which it is well-like, 0 5 mm wide; it is white within The apex is smooth and polished, the surface elsewhere dull, olive-buff, shading on the last whorl into cinnamon-brown or almost russet on the latter part of the whorl, which has a broad (1 7 mm) pallid band above the periphery The post-embryonic sculpture is of rather low and rounded riblets, about 4 in 1 mm on the last half whorl, they become subobsolete in the middle area of the base The aperture is formed about as in *P supraxonata* Pils , lip expanded and everted, gray, the teeth pure white The parietal tooth is hook-shaped, the upper branch hardly over one-third the length of the lower, lower branch failing to reach the columella by a distance about equal to the length of the upper branch Within the outer lip is a long, straight lamina running below into a somewhat higher, rounded tooth, projecting slightly forward of the lamina, a notch at their junction In the basal margin there is a smaller, obtuse tubercle, rather widely separated from the outer tooth, between this tubercle and the columella is a long, very low elevation Height 7 3, diam 11 5 mm , slightly more than 5 whorls

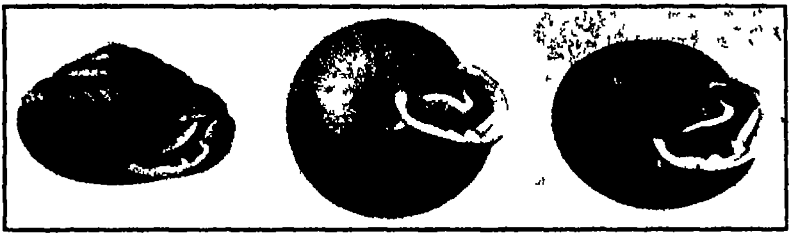

Fig 7 *Polygyra nayarita*

Tepic, State of Nayarit, Mexico Type, No 139841 ANSP, and another specimen collected by Mrs John W. Chason

This species, of the group of *P ventrosula*, is closely related to *P supraxonata* Pils from Tsintsuntsan, Michoacan The new form is thinner, dull, more globose, with a narrower umbilicus and distinct rib striation The color pattern is similar in the two species *P nayarita* is less closely related to the various other species of the same group in northwestern Mexico

SOUTH AMERICAN LAND AND FRESH WATER MOLLUSKS: NOTES AND DESCRIPTIONS —V

BY HENRY A PILSBRY

A *Megaspira* and various Amnicolidæ of Uruguay and southern Brazil are described herein Those of Uruguay, collected by Dr Florentino Felippone of Montevideo, supplement the monograph published in 1911, in my "Non-Marine Mollusca of Patagonia"[1]

In that monograph the references to figures of plate 41 B, in the text and on the explanation of the plate, are partly incorrect, owing to the fact that the engraver or the editor renumbered the figures after the plate left my hands Meantime, the text had already been printed The following explanation of figures of that plate should be substituted for that given

PLATE XLI B

1, 1b, *Potamolithus philippianus* Pils Type
1a, *Potamolithus philippianus* Young topotype
2, *Potamolithus buschii* Fray bentos
3, *Potamolithus rebeirensis* var, Hirircia
4, *Potamolithus lapidum elatior* Pils Type
5, 6, *Potamolithus rebeirensis* Pils Type
7, 7a, *Potamolithus chloris* Pils Type
8, 8a, *Potamolithus intracallosus* Pils Type
9, *Potamolithus paranensis* Pils Juvenile
10, *Potamolithus paranensis* Pils Type

Potamolithus fossæ n sp Text-fig 1, *a*, *b*

The shell is imperforate, rather solid, ovate-conic The conic spire is high for this genus, the whorls strongly convex, last whorl, strongly convex throughout, is noticeably more convex near the suture, a narrow zone somewhat flattened between suture and convexity The suture is deeply impressed Surface smooth The aperture is moderately convex, the peristome blunt, thickened near the upper insertion Parietal callus and upper part of the columella are thickened Length 7 2 mm, diam 5 4 mm, aperture incl peristome 4 3 mm, 5¼ whorls

Arroyo San Francisco, Paysandú, Uruguay Type No 139982 ANSP, collected by Dr F Felippone

This species differs from *P paysanduanus* by the less oblique aperture, less calloused inner margin of the peristome and the more produced spire It differs from *P catharinæ* Pils by being imperforate, though there is a short crease in the umbilical region, moreover, the outer lip is not expanded as in that species

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[1] Rep Princeton Univ Exped to Patagonia, III, pp 548–602

This form and *P callosus* appear to be fossils, probably dug out of the banks of the arroyo

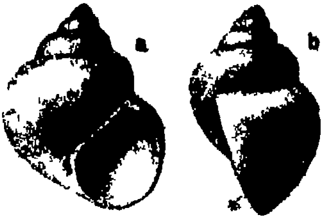


Fig 1 *Potamolithus fossæ*

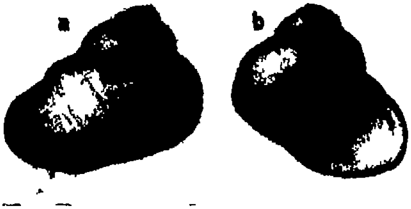


Fig 2 *Potamolithus tietensis*

Potamolithus tietensis n sp Text-figs 2, *a*, *b*

The shell is globose-conic, solid, smooth except for very faint lines of growth, olive The whorls are strongly convex, the last obtusely biangular, having rounded angles at the shoulder and base, flattened between them, the angles become obsolete immediately behind the aperture, where the whorl expands bell-like, the base is but slightly convex, having a strong dark keel defining a concave columellar area Aperture is strongly oblique, ovate The outer lip is rather thick, broadly expanded, grayish with a dark green edge, inner margin regularly concave, moderately thickened Alt 3 7, diam 4 2 mm

Itapura, Rio Tieté, State of São Paulo, Brazil Collected by Dr H von Ihering Type 109527 ANSP

Potamolithus paysanduanus v Iher Text-figs 3, *a*, *b*

Potamolithus paysanduanus von Ihering, Nautilus XXIV, 1910, p 15 Pilsbry, Rep Princeton Univ Exped Patagonia, III, 1911, p 590
Potamolithus lapidum var *elatior* Pilsbry, t c , p 588, pl 41B, fig 4

A long series of this species from Dr Felippone shows that "*P lapidum* var *elatior*" is merely an immature stage of *paysanduanus*, the individuals described having the spire longer than in the type lot of the latter, which consisted of low-spired individuals only Probably *P lapidum* does not occur in the Uruguay River system

The variation in size and in degree of elevation of the spire of *P paysanduanus* is considerable Some very small ones have the apertural characters of adults Extreme specimens measure:

Length 6 3 mm , diam 5 4 mm.
. " 4 2 " " 3 6 "

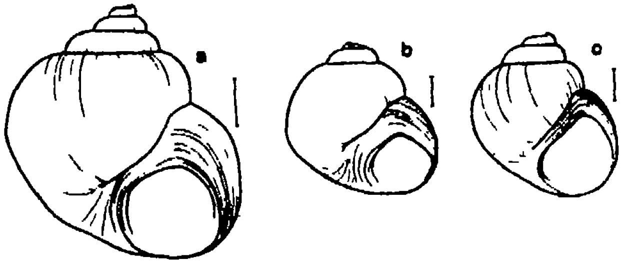


Fig 3 *Potamolithus paysanduanus* × 5⅓, to illustrate variation in size

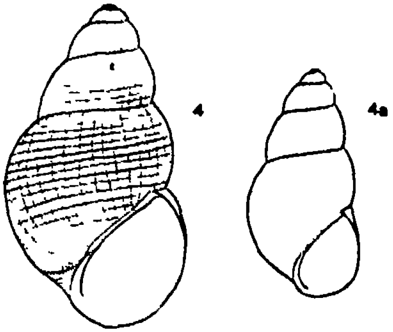
No transitional forms were found connecting typical *paysanduanus* and the supposed varieties *sinulabris* and *impressus* The status of these remains uncertain Further specimens of *impressus* confirm the characters originally assigned

Potamolithus callosus n sp Text-fig 5

The shell is globose-conic, smooth The whorls are strongly convex, the last one obtusely subangular below the suture, flattened above the angulation, weakly convex in the peripheral region, the base strongly convex A narrow, flat columellar area is defined by a slight ridge The aperture is very oblique, large and shortly ovate The outer lip is simple, without expansion or varix The inner lip is very heavily calloused, the columella broad and flat Length 3, diam 2 9 mm , 3⅔ whorls

Arroyo San Francisco, Paysandú, Uruguay, collected by Dr Florentino Felippone Type No 139984 ANSP

This appears to be a "subfossil" form With about the size of *P agapetus* Pils it differs by the subangular outline



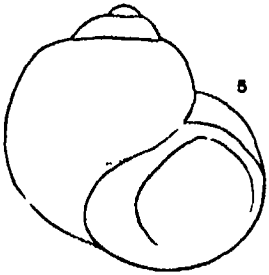


Fig 4 *Littoridina uruguayana* Fig 5 *Potamolithus callosus*

Littoridina uruguayana n sp Text-fig 4, 4a

The shell is ovate-conic, a little more slender than *L piscium* (Orb), olive colored, with rather widely spaced darker axial lines The whorls are rather strongly convex Sculpture of very small spiral threads, rather widely and unevenly spaced (mostly about 0 1 mm apart on the last whorl), their intervals showing many much finer spiral striæ, this sculpture being visible only under the microscope The aperture is ovate, slightly oblique, the outer lip thin, dark-edged The columella has a rather heavy white callus Length 3 5 mm , diam 2 mm , length of aperture 1 6 mm , 5 whorls

This species resembles *L piscium* in general appearance, but the columellar callus in heavier and the microscopic sculpture entirely different, *L piscium* being smooth

Uruguay River at Paysandú, collected by Dr Florentino Felippone Type 139980 ANSP

A more slender form, usually smaller, was sent with the form described above It has the same microscopic sculpture, and does not appear to be specifically distinct Whether the difference is sexual remains to be seen One figured (fig 4*a*) measures length 2 5 mm , diam 1 25 mm , aperture 1 mm , fully 5 whorls

Megaspira iheringi n sp Text-fig 6, *a*, *b*

A species related to *M elatior* (Spix), but shorter and stouter in figure Warm buff, with small, sparsely scattered spots of chestnut brown Closely sculptured with retractive striæ about equal to their intervals, 2½ in 1 mm on the face of the last whorl, the first 1¾ whorls smooth (worn) Umbilical cavity narrow, formed as in *M elatior* The whorls are nearly flat, the last convex, its latter part ascending a little The aperture is ovate, the outer and basal margins of the peristome expanded, columellar margin dilated above and deeply guttered at its insertion Columella with three small lamellæ The parietal lamella is rather small, oblique and enters deeply

Internally the parietal lamella ascends 3½ whorls The columellar lamella is enlarged within the penult and antepenult whorls, its edge in the former being *bent down* and weakly waved, in the antepenult undulating and lobed, but the lobes less strong than in *M elatior* The supracolumellar lamella enters about half a whorl and the infracolumellar slightly more than one whorl The transverse (radial) laminæ are high, with hooks at their summits directed towards the axis, as in *M elatior* Length 28 mm , diam 8 3 mm , length of aperture 7 mm , 14½ whorls.

Macate, State of Rio de Janeiro, Brazil Type No 100532 ANSP, from Dr H von Ihering

This is relatively shorter and stouter than any other known

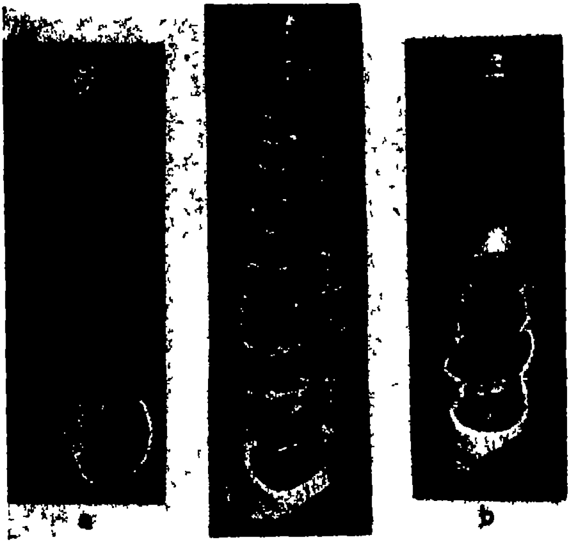


Fig. 6. *a, b, Megaspira iheringi.* *c, M. elatior.* All × 2.

species of *Megaspira,* with a smaller number of whorls. In a specimen cut open at the back (fig. 6 *b*) the columellar lamella is seen to be enlarged in two whorls only, in *M. elatior* (Spix) it is enlarged in fully three whorls (fig. 6 *c*). In *M. elatior fragilis* Pils. four whorls show this lamella enlarged. In *M. elatior robusta* Pils. the extent of the enlarged portion of the columellar lamella is little greater than in *M. iheringi.* None of these forms of *M. elatior* has this lamella shaped quite as in *M. iheringi,* it is more strongly lobed and less undulating in the forms of *M. elatior.* In the penult whorl its edge is deflected in *iheringi,* but not in *elatior* and its several subspecies.

PENROSEITE AND TRUDELLITE: TWO NEW MINERALS

BY SAMUEL G GORDON.

On the Third Academy Mineralogical Expedition· Bolivia and Chile, 1925, the writer visited the well-known localities Colquechaca and Cerro Pintados. Amongst the material obtained at these places were two minerals which proved to be new:

Penroseite	$2PbSe_2$ $3CuSe$ $5(Ni, Co)Se_2$, or $PbSe$ Cu_2Se $3(Ni, Co)Se_2$, orthorhombic, and
Trudellite	$Al_2(SO_4)_3$ $4AlCl_3$ $4Al(OH)_3.30H_2O$, trigonal

These are described below It is hoped to publish an account of the trip and a description of the other specimens at a future date

PENROSEITE

Penroseite was obtained in a small collection of minerals which the writer purchased from a local merchant at Colquechaca, Bolivia. This collection had been made by a miner named Castellana, whose widow had sold it to the merchant As far as could be learned, Castellana had worked in various mines in the vicinity of Colquechaca His collection consisted largely of specimens of "ruby silver" (pyrargyrite), native silver, argyrodite, argentite, and vivianite, all of which are typical minerals from mines in the vicinity of Colquechaca

In the collection was a single mass of a metallic mineral, which weighed about one kilogram It was slightly rounded and covered with a thin, brownish film of limonite In slight cavities in the surface the limonite was black and stalactitic Locally, the surface of the mass showed bluish-green stains of a nickel or copper mineral, and druses of brown, very minute, rhombohedral crystals which resemble siderite It would seem that the mass had not been found in situ, but probably represented a bit of "float"

When the mass was broken up, it was found to consist almost entirely of a lead-gray, radiating, columnar mineral A few small cavities, the largest of which was about 3 cm in length, were lined with brown rhombohedral crystals up to 3 mm in size of goethite pseudomorphous after siderite Some veins of limonite extended into the mass A few small crystals of cerussite were also noted in some of the cavities.

Physical Properties —The physical properties of penroseite are: color lead-gray, streak black, opaque, luster metallic, hardness 3; brittle, specific gravity 6 93

Crystallography —Penroseite is massive, with a radiating, columnar, or sometimes granular, structure There are four cleavages *c* (001) perfect, but curved, *a* (100), and *b* (010), perfect, and *m* (110) distinct The basal cleavage is curved, giving the mineral a concentric, botryoidal appearance, when viewed on such surfaces

Measurement of cleavage fragments showed the three principal cleavages to be at 90° with respect to each other[1], the mineral is therefore orthorhombic The prismatic cleavage gave too indistinct a series of reflections to obtain any trustworthy angles

Mineralography —When clean cleavage fragments of the specimen were examined in polished section under vertical illumination, they were seen to consist of three minerals 95 to 96 % of penroseite, 2 to 3% of a white selenide, and 2% of goethite or limonite The white selenide and the goethite or limonite appear as very thin veins through the penroseite The white selenide is present in amount about equal to the silver selenide indicated in the analysis, and is believed to represent a silver selenide, with the reagents, however, it behaves similarly to clausthalite, and may be that mineral The results of the mineralographic examination are given in Table I

Chemical Composition —Five grams of carefully selected cleavage fragments, free from visible impurities, were given to Dr J E Whitfield for analysis after a mineralographic examination for purity The results are shown in Table II No sulfur, antimony, tin, thallium, or germanium were found in the mineral

Penroseite is remarkable for its high content of selenium, as it contains about twice as much of this element as any heretofore described selenide In order to satisfactorily account for the selenium, maximum valencies must be assigned to the metals In Table III, the derivation of the following two formulas is indicated

$$2PbSe_2.3CuSe\ 5(Ni,Co)Se_2, \text{ or}$$
$$PbSe\ Cu_2Se.3(Ni,Co)Se_2.$$

The molecules $PbSe_2$ and CuSe assigned to the first formula do not occur in the known selenides, although the molecule $NiSe_2$ is analogous to the mineral melonite, $NiTe_2$ Moreover, a small amount of selenium is not accounted for This may be explained by supposing that the minute limonite veins carry some elemental selenium or selenium oxide, representing an alteration of the penroseite

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[1] The basal cleavage was not sufficiently curved to prevent measuring the angles n tiny fragments

TABLE I MINERALOGRAPHY OF PENROSEITE

Mineral	Penroseite	Unknown Mineral	Limonite
Color	Cream	White	Gray
Estimated Volume	95 to 98%	2 to 3%	2%
HNO_3	Effervesces Rapidly etches to rough gray surface Fumes tarnish brown	Turns brick red	Negative
HCl	Negative	Turns pale gray Rubs to paler tint	Slowly etches to darker gray?
KCN	Tarnishes brownish Rubs to paler color	Negative	Negative
$FeCl_3$	Negative	Turns pale gray with some iridescence Rubs to a paler color	Negative
$HgCl_2$	Negative	Negative	Negative
Hardness	Medium.	Low	Low

The second formula represents the molecules as PbSe, and Cu_2Se to conform with those occurring in the known natural selenides A slight deficiency of selenium is shown in the analysis of the mineral with that required by this formula

The silver is present in amount equal to the quantity of the white mineral occurring in thin veins in penroseite, and it is believed to be present as a silver selenide

While a cobaltiferous variety of clausthalite has been given the name tilkerodite, this is the first nickel selenide to be reported

Pyrognostics —Penroseite is easily fusible, coloring the flame a beautiful azure blue. It gives off reddish-brown smoke, with an occasional white wisp at the border of the smoke column The characteristic disagreeable "horse radish" odor of Se is instantly experienced. These details are even observable in a candle flame

Before the blowpipe, the mineral decrepitates. In the closed tube penroseite decomposes, and a coating of selenium is deposited on the wall of the tube, lower down the coat is black, and is seen to consist of globules of selenium, higher up, the coat consists of translucent, acicular, red crystals

The mineral dissolves readily in HNO_3 with effervescence The solution upon the addition of NH_4OH in excess turns a methyl blue (Cu and Ni) Dimethyl glyoxime yields a scarlet precipitate (Ni)

TABLE II· ANALYSIS OF PENROSEITE
BY DR. J EDWARD WHITFIELD

	I	II	III
Se	59 80	60 23	7604
Ag	2 04	2 05	0190
Pb	17 13	17 25	0833
Cu	7 84	7 90	1243
Ni	11 14	11 22	1912 } 2141
Co	1 34	1 35	0229
Fe_2O_3	1 08		
	100 37	100 00	

I Analysis by Dr J Edward Whitfield
II Analysis recalculated omitting Fe_2O_3
III Formula ratios.

TABLE III DERIVATION OF FORMULA OF PENROSEITE

Molecular Ratios		$2PbSe_2$ $3CuSe$ $5(Ni, Co)Se_2$			PbSe Cu_2Se $(Ni, Co)Se_2$			
Se	7604							
Pb	0833	$PbSe_2$	0833	= 0416 × 2	PbSe	0833	= 0208 × 4	(1)
Cu	1243	CuSe	1243	= 0414 × 3	Cu_2Se	0621	= 0207 × 3	(1)
(Ni, Co)	2141	$NiSe_2$	2141	= 0428 × 5	$NiSe_2$	2141	= 0214 × 10	(3)

Locality—Colquechaca is situated in Bolivia, about 150 kilometers southeast of Oruro A railroad extends in this direction as far as Catavi, from which point Colquechaca is about a day and a half to two days' trip by mule The mines are situated in the Cerro Hermosa, an intrusive mass of rhyolite The ore occurred locally in fissure veins in the rhyolite, and the district owes its celebrity to the many rich pockets of ruby silver (pyrargyrite) formerly found. Very little mining activity is evident at present

Reasons were given in the introduction for believing that the penroseite was not found in situ, but was a bit of "float" from some unworked prospect, or undiscovered vein Some doubt therefore exists regarding the exact locality As the rest of the collection, of which the penroseite was a part, consisted of characteristic specimens from the mines at Colquechaca, it seems certain that the mineral came also from the vicinity It may be remarked that no selenium or nickel minerals have heretofore been reported from Bolivia.

About 1000 miles farther south in the Andes, at Cacheuta near Mendosa, Argentina, many selenides were formerly found; none however, contained nickel, and it seems incredible that this specimen could have come from that remote district.

Name—It is a pleasure to name this new mineral in honor of Dr. Richard A. F. Penrose, Jr

TRUDELLITE

About 80 kilometers southeast of Iquique, in the Province of Tarapacá, Chile, is Pintados, the well-known locality for pickeringite and tamarugite Pintados may be reached by railway from Iquique, or Antofagasta It is a cluster of buildings, lying near the eastern foot of the Coastal Hills, which at this point were formerly known as the Cerro Pintados It is also at the western edge of the Tamarugal Pampa, in which, to the northeast, is the oasis of Pica In the distance across the Pampa Tamarugal are the Western Cordillera of the Andes.

On the hillside, just above the floor of the pampa, are two groups of trenches and pits, respectively one and two kilometers northwest of Pintados station. The larger working, two kilometers northwest of Pintados, is the locality for the fine fibrous masses of tamarugite and pickeringite seen in many older collections.

The smaller group of pits and trenches, one kilometer northwest of Pintados, are little more than prospect diggings The principal minerals there are gypsum, anhydrite, pickeringite, and the new mineral trudellite.

The Coastal Ranges in general consist of Cretaceous limestones and other sediments, lying unconformably upon crystalline schists, gneisses, gabbros, etc. The underlying rocks are obscured by a talus breccia, covered with gravel At the trudellite locality, the excavations exposed a compact, fine-grained, buff-colored rock, which on optical examination proved to be largely composed of anhydrite and gypsum This rock probably represents an altered limestone The gypsum, pickeringite, and trudellite occur as veins cementing the overlying talus breccia, just beneath the wind-blown gravel layer This breccia consists at the pits, of a mottled-red and gray rock, now largely composed of sulfates It was not possible to determine the original rock from the examination of crushed fragments Trudellite frequently contains tiny red fragments of this altered rock, and the mineral was probably the result of its alteration

Nearby, another pit exposed a pyritic vein in a conglomeratic rock, indicating that the decomposition of pyritic veins may have contributed to the origin of the sulfates The pampa up to the foot of the hills, shows evidence of former working for nitrate

Perhaps the most abundant mineral at the trudellite locality is gypsum, it occurs in fibrous masses, with the fibers perpendicular to the walls of the veins Sometimes the gypsum fibers are curved Some powdery anhydrite is found with the gypsum The pickeringite occurs in compact, yellow masses, with an extremely fine, short fibrous structure The fibrous appearance is indicated by a silky sheen when the specimen is held in the proper direction The pickeringite is evidently the result of alteration of another sulfate, perhaps trudellite

At the pits two kilometers northwest of Pintados, the pickeringite occurs as white, silky, long, fibrous masses, which are sometimes rose pink when freshly broken The associated tamarugite occurs in coarse fibrous masses, which are colorless or white, and show a pronounced prismatic cleavage

Physical Properties—The color of trudellite is amber yellow (Ridgway) The luster is vitreous The hardness is about 2 5 The specific gravity was determined by dropping freshly broken fragments into mixtures of benzol and bromoform, and found to be 1 93

Optical Properties—Optically, trudellite is uniaxial negative The indices of refraction were determined by the immersion method Some difficulty was encountered owing to the deliquescent character of the mineral This was overcome by dropping fragments in the index oils and crushing them under the cover glass The indices of refraction obtained for Hg yellow light are.

$$\epsilon = 1.495,\ \omega = 1\ 560,\ \omega - \epsilon = \ 065,\ \text{all} \pm .005$$

Crystallography.—Trudellite occurs in compact masses, with an indistinct rhombohedral cleavage, the mineral is therefore trigonal. This was at first determined from the optical properties. Fragments under oblique illumination showed only a single quadrant of a uniaxial figure, it was therefore suspected that the mineral was lying on a cleavage at some angle to the vertical axis. Such a cleavage is rare in the hexagonal and tetragonal systems, but common in the trigonal system. Careful inspection of cleavage surfaces substantiated the conclusion that the cleavage was rhombohedral. Under the microscope occasional fragments were found that had a rhombohedral outline, and showed symmetrical extinction. The cleavage, however, was too indistinct to obtain any goniometric measurements.

Chemical Composition.—An analysis, given in Table IV, was made of trudellite by Dr. Earl V. Shannon, who also kindly furnished the following details. Owing to the very deliquescent character of the mineral, the analysis was attended with difficulty.

The sample was crushed and quickly ground in an agate mortar and sealed in a vial. All portions analyzed were weighed out at the same time, and most of the constituents were determined on a single sample of 2.5 grams, which was weighed out and boiled in water.

Another portion of 0.5 gram was weighed in a small porcelain crucible, and placed in a drying oven for 4 hours, with hourly weighings, with the following losses first hour 17.66%, second hour 5.70% third hour 7.44%, fourth hour 3.40%. The sample was then placed in a dessicator over $CaCl_2$ to stand overnight, whereupon it regained 1% in weight. Again heated for an hour at 112° it lost 2.10%. The total loss in 5 hours was thus 35.30%, of which it was later determined that 13.30% was chlorine. The sample was then transferred to a Penfield water tube and 14.60% additional water was obtained. A total direct water determination by the Penfield method gave 36.60%. A portion of 0.5 gram allowed to stand in an open porcelain crucible for 24 hours lost 4.10%. Another 0.5 gram portion, allowed to stand 72 hours over H_2SO_4 of a dilution equivalent to a water vapor pressure of 19 mm of mercury, took up 129.44% of its own weight of water, went into solution and hydrolyzed. A portion of 0.5 gram allowed to stand 72 hours in a dessicator over $CaCl_2$ lost 4.46% H_2O

If the soda, magnesia and lime be ignored, as probably present as impurities, the ratios yield the following formula:

$$5Al_2O_3, -6O\ 3SO_3.\ 12Cl.\ 36H_2O, \text{ or}$$
$$Al_2(SO_4)_3.4AlCl_3.4Al(OH)_3.30\ H_2O$$

Optical examination of the sample analysed showed it to be apparently composed of a single mineral.

ANALYSIS OF TRUDELLITE

BY DR. EARL V SHANNON

	I	II		III	IV
SiO_2	0 57				
Al_2O_3	25 67	251	257	051 × 5	29 54
Fe_2O_3	1 00	006			
CaO	1 56	028	067		
MgO	0 66	014			
Na_2O	1 58	025			
SO_3	13 60	170	170	057 × 3	13 80
Cl	24 42	689	689	057 × 12	24 60
H_2O	36 60	2 032	2 032	057 × 36	37 54
	105 66				105 54
Less 0 = Cl_2	5 49				5 54
	100 17				100 00

I Analysis of trudellite by Dr Earl V. Shannon
II, III Formula ratios.
IV Theoretical composition

Pyrognostics—The mineral is very deliquescent It has a sweet, astringent taste. On dissolving in water, some of the alumina is precipitated. It thus behaves similarly to some of the soluble complex calcium sulfates, in which Ca sulfate is thrown down. However, it can be distinguished from these by the insolubility of the precipitate. $AgNO_3$ yields a characteristic precipitate (Cl), as does $BaCl_2$ (SO_4)

Before the blowpipe the mineral is infusible. After strongly heating and moistening with $Co(NO_3)_2$, and heating again, the characteristic blue color indicating Al is obtained. In the closed tube, trudellite yields much acid water

Name—The writer takes pleasure in naming this mineral trudellite, after Mr. Harry W. Trudell, well-known Philadelphia amateur mineralogist, and member of this Academy.

A FRESH-WATER SNAIL, PHYSA ZIONIS, LIVING UNDER UNUSUAL CONDITIONS

BY H A PILSBRY.

In the course of a journey through southern Utah and northern Arizona, in company with my brother F W. Pilsbry and John Witherspoon of Pasadena, a stop was made in Zion Canyon, Zion National Park. The mollusks collected here and at other places visited are to be discussed in a future paper, but one species of the family Physidæ, interesting for its unusual station on vertical cliffs, will be described here

The stream in Zion Canyon, the Mukuntuweap River, an affluent of the Virgin River, is swift, turbid and generally shallow, flowing over a stony bed No mollusks whatever were found in it[1] Probably none could exist there long, as the stream, though usually insignificant, swells rapidly to a torrent during rains, and appears to carry a good deal of sediment

The canyon has a rather ample, level bed in the lower and middle parts, but near the head of the trail the rock walls close in and tower directly above the footpath along the stream, or recede only enough to allow the accumulation of a short, steep talus slope, where *Oreohelix* and other land snails are abundant

In some places water seeps from joints along bedding planes in the cliffs. The wet rock faces below become coated with green algæ; and it is on these patches of algæ, occurring isolated here and there on the vertical walls, that the only fresh-water mollusk of Zion Canyon lives. It is a pygmy species of *Physa*, much smaller than any yet known, and peculiar for its small spire and relatively large last whorl and aperture The water irrigating the patches of algæ bears considerable lime in solution Becoming concentrated by evaporation, lime is deposited on the face of the rock, on shells and other objects The diminutive size of the snails is thus not traceable to shortage of shell material While this was conspicuous in the type colony, no lime incrustation was noticed in another patch examined

Above the end of the trail, the Canyon becomes narrower, a true box canyon, locally known as "The Narrows." The stream flanked by gravel bars occupies practically its whole width, but it is easily accessible on horse back for about a mile further The photograph numbered 2 on the plate was taken in this stretch Only a few Physæ were found here Beyond this, the bars become small and few, and one has to swim the horse through a few deep holes In places the sixteen-hundred-foot cliffs overhang the stream, shutting out the sky The windings of the huge crevasse, giving ever-changing views of strange erosion forms in the twilight, tempt one to push on, but some quicksand deposits discourage exploration At the highest point reached, two or three miles beyond the "Mount of Mystery" where a large fork enters from the right (east), a flourishing colony of *Oreohelix cooperi* was found on the left side At this place there are two narrow crevices and a small talus with pine trees on the west side, in the stream many huge rocks and a deep hole, the third encountered of more than horse depth No *Physa* colonies were found in this part of the canyon

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[1] We did not look for them in the section near the mouth of the canyon, where it is deeper and less turbulent

The short, broad contour and ample aperture of the shell of *Physa zionis*, as this species shall be called, are correlated with a relatively large and very broad foot, apparently adapted to afford the suction needed for secure foothold on the vertical substratum when flooded by heavy showers. The hemispherical shell, with evenly rounded surface and practically no projecting spire, appears to be another adaption to the same end It is shaped like the Neritinæ of rapid rocky streams, such as those of Fiji, and approaching the contour of *Ancylus* and other limpets

Except in the direction of coil, *Physa zionis* has a striking resemblance to the Hawaiian *Erinna*, which inhabits mountain streams on rocks, and is probably an adaptive modification of *Lymnæa* The convergence in shell characters of these two mollusks, one physid, the other limnæid, is astonishing *Physa globosa* Hald. found on submerged rocks in the Nolachuky River, is the nearest of our American species, but still very unlike *P zionis*

Physa zionis new species. Plate XI, figs 5, 6

The shell is imperforate, thin, cinnamon colored, of a semiovate or nearly semiglobular shape, the spire very small and low. The last whorl is very much inflated, somewhat compressed around the upper part, with sculpture of minute, close delicate striae or growth-lines The aperture is nearly as long as the shell, very broadly ovate or somewhat piriform The outer lip is thin and sharp The columella is very broad and straight in the middle, its face somewhat excavated or furrowed axially; becoming concave below It is bounded on the right by a thin, rather wide, closely appressed callus

Length 4 5 mm , diam 3 6 mm , length of aperture 3 9 mm 2½ whorls Type, fig 5

Length 3 6 mm., diam 3 3 mm , length of aperture 3 3 mm 2½ whorls, fig 6

The mantle is intensely black with a white border In the alcoholic specimens I could find no trace of mantle digitations Those at the posterior angle and on the columellar border are conspicuous in alcoholic specimens of *Physa* Unfortunately, I did not look for them in the living snails The foot is very broad for a *Physa*, but pointed behind The muzzle is also very broad, emarginate in front The tentacles, as contracted in alcohol, are cylindric or slightly tapering, but very blunt at the ends, not conic and pointed as in other alcoholic Physæ compared This point also calls for examination in living specimens The posterior basal processes of the tentacles are relatively larger than in *Physa ancillaria* and others compared Eyes were not seen, if present the pigment spots must be very small

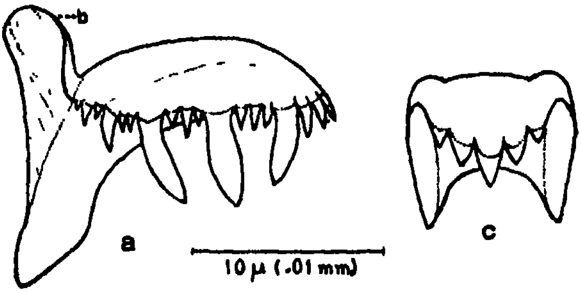

Fig 1 Second lateral and central teeth of *Physa zionis*[1]

The radula has the broad outline and V-shaped rows of teeth characteristic of Physidæ The short, squarish central tooth (Fig 1, c) has a broad reflection and five strong cusps There are over 70 teeth on a side, having the form shown in Fig 1a (the 2d lateral) It is an obliquely rastriform type of tooth The basal plate runs obliquely backward and from the median line of the radula, with a forward extension evidently functioning as a brace (Fig 1, b)[2] The reflection bears four large and long cusps, with groups of small cusps in the intervals, most of the groups composed of three cusps There is a slight increase in size of the teeth from the first outward for a short distance, after which the size remains uniform Between the 50th and 60th teeth the basal plates become slightly longer

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[1] I am indebted to Dr H Burrington Baker for the drawings of these difficult objects, and various observations on them

[2] This brace-like forward extension of the basal plate has usually been very sketchily represented in figures of *Physa* teeth

While the teeth are distinctly physid, they are remarkable for the small number of large cusps and the multiplication of small interstitial ones

In a small lot collected since our visit by Mr A M Woodbury, Naturalist of Zion Park, the shells average a little larger, and the columellar callus is narrower with a concave outline, its face not excavated Two of these shells are drawn in Plate XI, figs. 3, 4 One measures: length 4 7 mm , diam 3 8 mm., length of aperture 4 1 mm , 2½ whorls

Further collecting, keeping the shells of each colony separate, might possibly show that there are recognizable racial differences between snails of the more widely isolated colonies

Aside from the characters of shell and foot, which are apparently to be considered adaptations to life on a vertical plane, this *Physa* has several peculiarities, such as the absence of mantle digitations and the arrangement of cusps on the teeth, which isolate it in a new subgenus or section, to be called *Petrophysa*

EXPLANATION OF PLATE XI

Fig. 1 —View of the type locality of *Physa zionis*

Fig. 2 —Another locality for *Physa* in "The Narrows." Green algae on a white cliff

Figs. 3, 4 —*Physa zionis*, form with narrow columella. Natural size is shown by small figures on the right.

Figs 5, 6 —*Physa zionis*, type (fig 5) and paratype

MOLLUSKS FROM QUERÉTARO, MEXICO

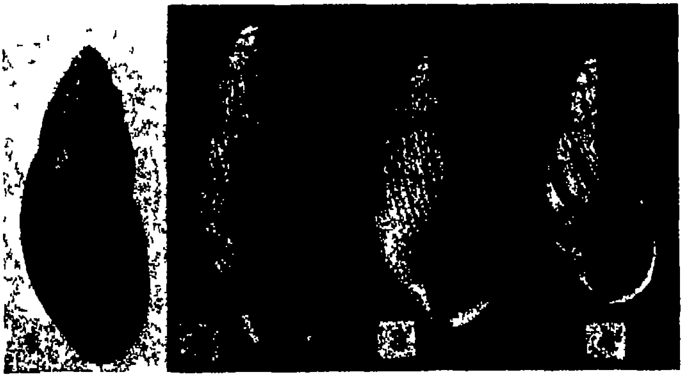
BY H A PILSBRY.

A small lot of mollusks from around Querétaro, sent by Dr Luis M. Vega, Director of the Colegio Civil del Estado de Querétaro Arteaga, contained the following species The description of an *Eupera* from the State of Vera Cruz is added

Euglandina fischeri (v Mart) Text-figs 1, 2, 3

This is a rather thin shell, with glittering, pecan-brown surface The first 2½ whorls are smooth, the rest having unequal, rather flattened axial riblets, stronger near the suture, weaker and partly effaced below the middle of the last whorl In a suitable light, very faint traces of spiral lines can be seen on the upper part of the last whorl of the most perfect examples The columella is moderately or strongly concave. Suture is only weakly, irregularly denticulate The parietal callus is scarcely perceptible

The type of this species was from Toluca, about 40 miles southwest from the City of Mexico It measured, length 37 mm , diam 15 mm , length of aperture 18 mm. The Querétaro specimens are larger; an average one measuring, length 41 8 mm , diam 16 3 mm., length of aperture 21 5 mm , 6½ whorls (Fig 1)



Figs 1, 2, 3 —*Euglandina fischeri* 4, *Drymaeus hegewischi*.

One specimen in the lot sent is decidedly shorter than the others, but having the same sculpture, it is for the present considered to be an individual variant rather than a distinct species. This specimen (Fig 3) measures, length 37 4 mm , diam 17 mm , aperture 20 5 mm

Euglandina herrerae (Contreras),[1] from Chapala, State of Jalisco, which I have not seen, is a shell of similar form, but having coarser denticulation of the suture among other differences, thus approaching *E liebmanni*

Other gastropods taken at Querétaro are·

Drymaeus hegewischi (Pfr) Text-fig 4

Agriolimax lævis (Müller), or one of that group, specimens in poor condition

Succinea undulata Say

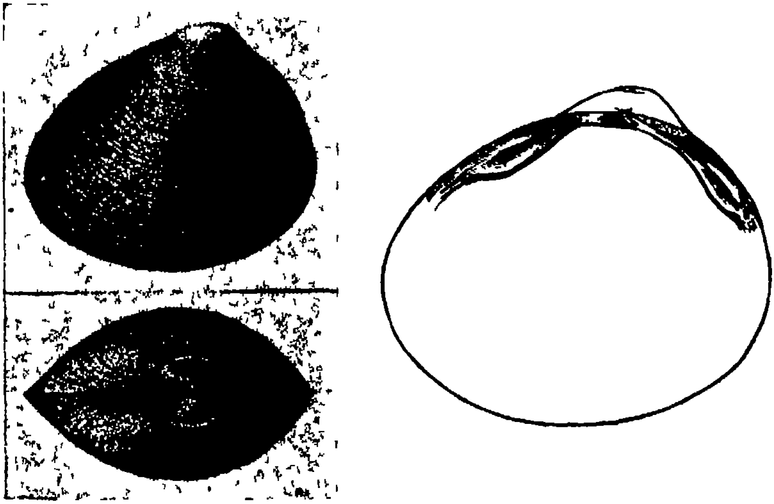
Physa berendti Dunker

Planorbis caribæus Orb

The specimens of the last species represent a rather small form, two measuring height 5 3 mm , diam 11 mm and 4 3 × 11 mm , thus varying in height The largest has a diameter of 13 mm

Pisidium vegæ new species. Text-figs 5, 6

The shell is oval-triangular, moderately plump (the diameter nearly 60 per cent of the length); beaks are rather prominent and bear curved ridges, much as in *P compressum* Prime; of a light drab color, with a paler basal zone The surface is rather glossy, very finely and rather sharply striate. The right valve has



Figs 5, 6 —*Pisidium vegæ*

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[1] *Glandina herrerae* F Contreras, Boletin de la Sociedad de Estudios Biologicos I, May, 1923, p 13, plate with 3 figures.

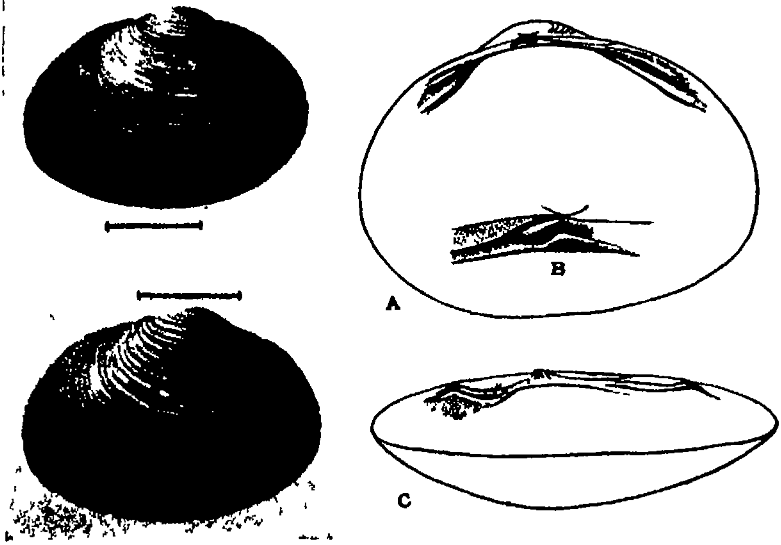
a long, gently curved cardinal tooth and stout double laterals The hinge plate is deeply concave between cardinal and anterior lateral teeth The ligament pit is quite short The left valve has a long, rather massive anterior cardinal tooth, its summit regularly arched, and a small, slight posterior cardinal The single laterals are high and short Length 3 9 mm , height 3 2 mm., diam 2 25 mm

Querétaro Type 140184 ANSP, collected by Dr Luis Vega

With a general resemblance to some forms of *Pisidium compressum*, this species differs by the narrower hinge-plate and far slighter lateral teeth The striation is not so close and strong as in typical *P compressum*, and there are some differences in the contour Named for Dr Vega

Sphaerium queretaronis new species Text-figs 7, 8.

The shell is slightly rhombic oval, the posterior end a little larger and more oblique than the anterior Surface strongly, very sharply and closely sculptured with concentric riblets, this sculpture also on the moderately full but low umbones The external sculpture is visible inside as a weak corrugation. The right valve, (fig 8*a*, *c*), has a slender, curved cardinal tooth, its summit grooved posteriorly Lateral teeth are double, not very strong, and do



Figs. 7, 8a–c *Sphaerium queretaronis*

not project above the level of the hinge margin. In the left valve there is a laminar posterior cardinal tooth, a stouter, broadly triangular anterior one (fig 8*b*). The single laterals project well above the hinge margin Length 1 3 mm , height 9 mm , diam 6 4 mm

Querétaro Type 140185 ANSP, collected by Dr Luis M Vega

This species is related to *Sphærium triangulare* (Say), but differs by its transversely oval instead of subtriangular shape, the height being less than in *triangulare* It is also much like some specimens of the variable northern species, *S striatinum* (Lam), but when that species is as strongly sculptured as *queretaronis* the riblets are irregularly developed, while in this Mexican clam the whole valve is evenly ribbed In *S. queretaronis* the interdental area between cardinal and anterior lateral teeth is much excavated, strongly concave, as in *S triangulare* and some other species.

Eupera insignis new species Text-fig 9.

The shell is plump, very shortly oval, the height about 85 per

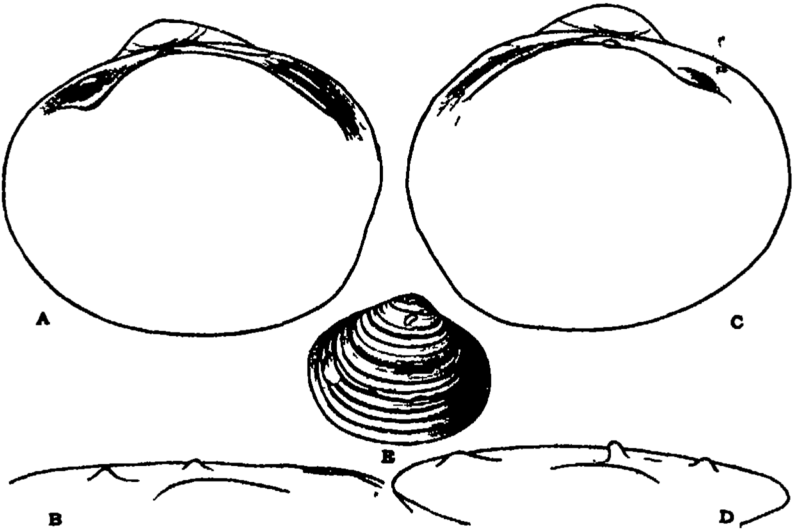


Fig 9 —Eupera insignis.

cent of the length, very thin The ends are broadly rounded, the posterior somewhat longer and higher than the anterior, dorsal and ventral margins are rather strongly and subequally convex. The beaks are full and project well above the dorsal borders of the valves. Surface without much gloss, buff, varying in tint, with sculpture of widely and irregularly spaced concentric threads and irregular laminæ, stronger and more irregular in the lower half of the valve. Cardinal teeth are single in both valves. In the right valve (fig. 9*a*, *b*) it is very thin, short and moderately high, in the left, (fig. 9*c*, *d*) it is shorter, thicker and higher. The anterior lateral teeth are short, very stout and double in the right, single in the left valve, (fig. 9*c*, *d*). The posterior laterals are rather short, not so high as the anterior. The ligament-pit is rather deep. Length 4 mm., height 3.3 mm., diam. 2.5 mm.

State of Vera Cruz, the type 13377 ANSP, collected by H. Burrington Baker in La Laja, a sluggish stream off of the Arroyo Hueyapam, a tributary of the Rio San Juan in the Canton of Acayucan, southern Vera Cruz.

This *Eupera* is notable for its strong sculpture, the short, rounded contour, and the strongly developed anterior lateral teeth,—features found in no other known species of this genus. None of the dark spots generally seen in these clams is noticeable in the specimens examined. While the general appearance is that of a *Pisidium*, the single cardinal teeth of both valves and the greater length of the posterior (instead of the anterior) end show at once that it is an *Eupera*.

The specimens described are part of the lot recorded by H. Burrington Baker as *Pisidium atlanticum* Sterki,[2] a species which has been found in the State of Vera Cruz.[3] While *atlanticum* is somewhat similar in outline to *E. insignis*, the surface is much smoother. It has not been figured.

Anodonta coarctata Anton.

The specimens from Querétaro are more oblong and thinner than those from the State of Jalisco, but appear to be referable to *coarctata*, not to *A. impura* Say, which is the common species of the environs of the City of Mexico, and I believe the only *Anodonta* found in that neighborhood. *A. chalcoensis* C. & F. is identical with *A. impura*, as von Martens surmised.

Anodonta exilior Lea is an allied species of the humid tropical Vera Cruz region, certainly distinct from *A. impura* (+ *chalcoensis*) of the central plateau. Young shells, up to about two-thirds adult size, have a peculiar sculpture of the interior—fine wrinkles cut by minute, incised radial lines In old shells this becomes covered and disappears This sculpture is not present in any specimens of *A impura* I have seen, but no very young ones are at hand.

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[2] Occas. Pap. Mus. Zool. Univ. Michigan, No. 135, 1923, p. 2.

[3] At Texolo, collected by S. N. Rhoads, No. 77184 ANSP., determined by V. Sterki.

THE GENUS AFZELIA: A TAXONOMIC STUDY IN EVOLUTION

BY FRANCIS W PENNELL

In attempting a study of the scrophulariaceous plants formerly placed in the genus *Gerardia*, the related small genus *Afzelia*, or under the International Rules of Nomenclature *Seymeria*, was fortunately included While it is planned to present in these PROCEEDINGS under the caption "Agalinis and Allies in North America" a summary of our knowledge of the whole series of genera considered, the remarkable floral evolution revealed in *Afzelia* makes it seem worth while first to isolate that genus and to consider in some detail its taxonomy and phylogeny

The genus *Afzelia* is related to *Aureolaria* and obviously more nearly to *Dasistoma*, but the discussion of its broader kinship may safely be deferred until this later paper The evolution now to be discussed involves the development of characters within the limits of the genus, from species to species In the detailed revision below, the description of each species is made to answer every point in which specific contrasts have been noted Among these may be some features the occurrence of which seems sporadic or irrelevant, but there are also others which appear in correlation, and in which definite advance may be detected from a primitive to a highly evolved condition While these changes of course are indicated on the key to the species, their analysis and interpretation, and their further correlation with geographic distribution, call for special discussion

Among the species of *Afzelia* floral differences are discernible in the following points. (1) the relative length of the united portions, forming the tube, to the free portions, the lobes, of the corolla, (2) the length of union of the posterior lobes of the corolla, (3) the construction of the filament, and (4) the length of the part of the anther-cell that opens in dehiscence Since the most obvious indication of the direction of the evolution involved is shown by the anther-dehiscence, we may select for consideration this feature first

In nearly all other genera of the Scrophulariaceae, as indeed in nearly all families of flowering plants, the anther-cells open in dehiscence throughout their entire length There can be no question of such generalized dehiscence having been primitive in Scrophulariaceae, and only this state is found in the near relatives of *Afzelia*, in *Dasistoma*, *Aureolaria*, *Agalinis*, etc In *Afzelia* we find such dehiscence universal among the perennial species, the Virgatae (Text fig 1, B), while among the annual species we find many gradations from this to a dehiscence opening the anther-cell for only one-sixth to one-fifth of its length, thus forming practically a terminal pore (Text figs 2, B, 3, B, and 4) The extreme stage of this tendency is shown by *A pectinata* and *A cassioides* Here the evidence as to the direction of evolution seems conclusive, the change surely has been from dehiscence throughout the anther-length to dehiscence only at apex.

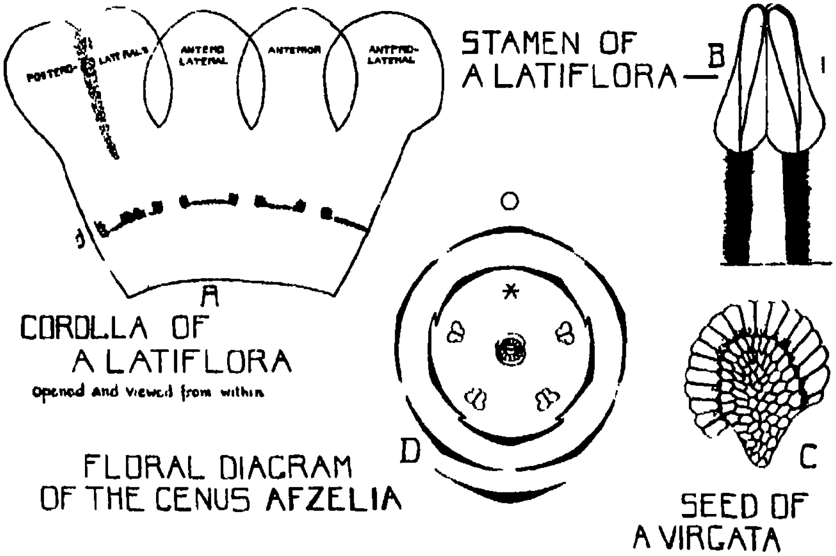

Fig 1 *Afzelia*—Virgatae. A —Corolla of *A latiflora* showing the different petals, the bases of the four filaments and a tuft of hairs indicating the former position of the posterior filament B —Stamen showing dilated hairy filament and anther-cells opening throughout length C —Seed of *A virgata*, showing conspicuous wing D —Floral diagram

Now with this as a criterion and foundation of our arrangement, let us group as primitive or advanced the associated changes in the filament and in the corolla The filament in the perennial Virgatae is broad, flattened and ciliate (Text fig 1, B), and is practically that of the allied genus *Dasistoma*. But in the annual species one finds all stages of change from this to a filament flattened and ciliate only at base, but distally transformed into a slender filiform process which is usually glabrous. Indeed only in *A. pectinata* is this process pubescent, but there the hairs are of a quite unique character and surely of recent phylogenetic development. Although there may be some deviations from the sequence already decided according to anther-dehiscence, a like evolutionary progression is clearly evident, culminating again in the same two species, *A. pectinata* and *A. cassioides* (Text figs. 2, B, 3, B, and 5). While from comparison with closely related genera we might have felt reasonably sure which type of filament was primitive, the evidence derived from the correlation of the filament-structure with that of anther-dehiscence makes us still more certain of the direction of the evolution involved. There has occurred a shortening of the broad, flat, hairy primitive filament, and increasingly the development of a slender, terete, glabrous, distal portion, thus making the entire filament a much more delicate structure. This transformation has taken place more rapidly in the anterior than in the posterior filaments.

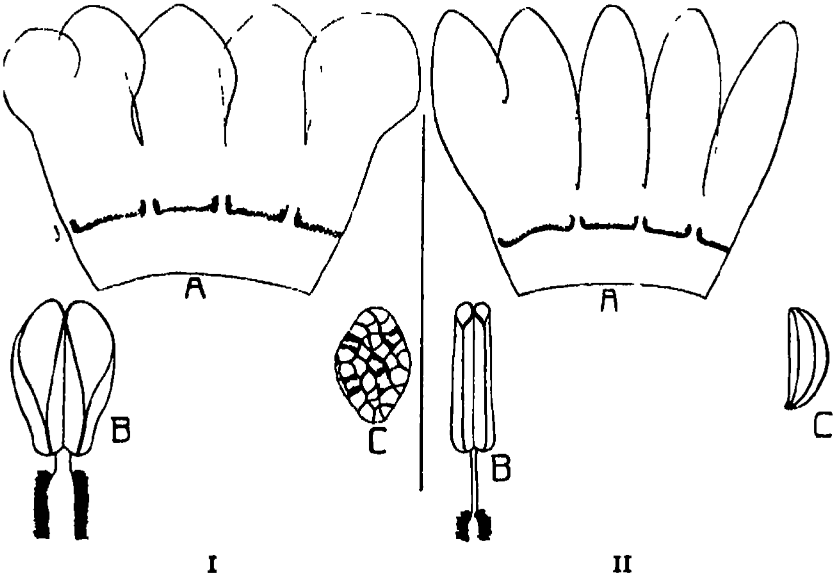

Fig. 2. *Afzelia*—Cassioides. I.—*A. laciniata.* II.—*A. cassioides.* A.—Corolla opened and viewed from within. B.—Postero-lateral stamen. C.—Seed.

The corolla in the perennial Virgatae is closely similar to that of

Agalinis, and other related genera, being campanulate, formed of petals united much over half their length (or in different phrasing with the corolla-lobes shorter than the tube), and having the posterior lobes joined and arched most of their special length (Text fig 1, A) Exactly as in *Agalinis*, the corolla is pubescent below the posterior sinus, although this feature is lost in *Afzelia pinnatifida* Also a tuft of hairs marks the former position of the posterior filament Yet again as to the corolla, the annual species show stage after stage of change from such a condition until eventually one

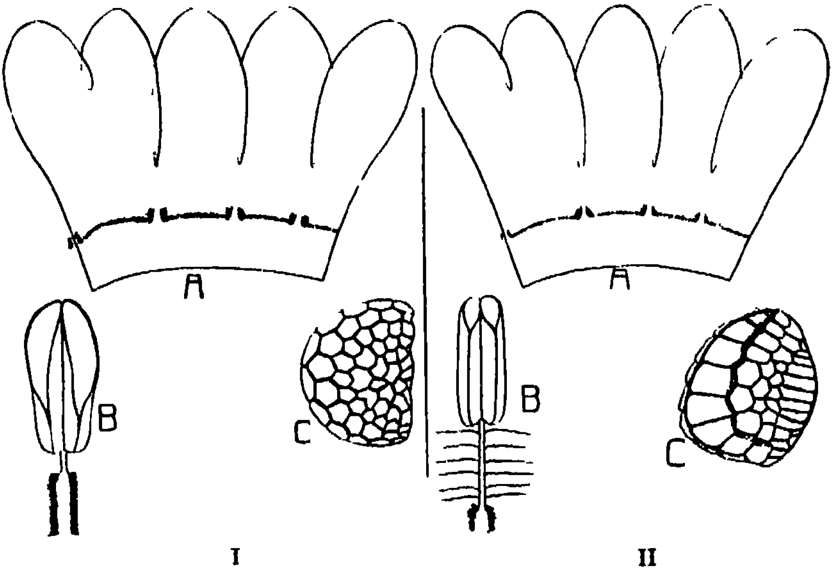

Fig 3 —*Afzelia*—Pectinatae I —*A sinaloana* II —*A pectinata* A — Corolla opened and viewed from within B —Postero-lateral stamen C —Seed

reaches an open, almost rotate, corolla, with lobes much longer than the tube, the posterior lobes becoming much more distinct, and the corolla consistently lacking dense pubescence below the posterior sinus or at the base of the former posterior filament (Text figs 2, A, and 3, A) Again *A cassioides* shows the extreme degree of change, but in these characters some species of the Bipinnatisectae have nearly kept abreast of *A. pectinata* From the correlation with anther-dehiscence and filament-transformation we may here also be sure of the course of evolution involved, from a primitive campanulate corolla, with the associated features of the Virgatae, to the rotate corolla of species such as *A. cassioides* Inasmuch as there has occurred a partial separation of petals which had before been joined to form an elaborate corolla, thus affording a seeming reversal of the process which must once have played its part in the original formation of such a sympetalous structure, this change seems of particular significance Among Scrophulariaceae such an evolution is not unique in *Afzelia*, but has evidently occurred in *Veronica* and likely elsewhere

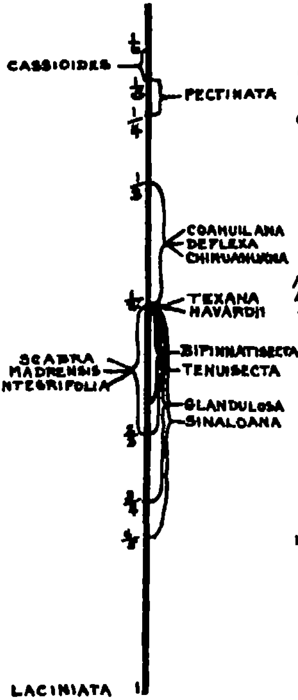

Fig 4

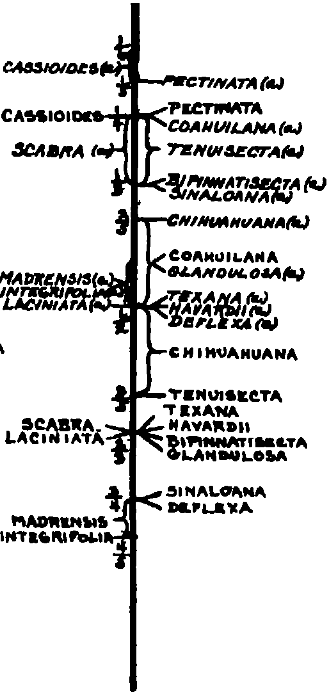

Fig. 5

Fig 4 —The annual species of *Afzelia* arranged according to the length of the dehiscing portion of the anther-cell, the fraction of the anther-length that opens is indicated by figures. Fig 5 —The annual species of *Afzelia* arranged according to the degree of transformation of the filaments, the proportion of the dilated and hairy proximal portion to the entire length of the filament is indicated by fractions. When the name of the species is in erect type reference is made to the postero-lateral filaments, when in slanting type and accompanied by "(a)" to the antero-lateral filaments.

The total floral change has been from a campanulate corolla, (into which a bee or similar insect must crawl and so find itself dusted upon the back with the pollen poured from anthers which are held rigidly on the posterior side of the entrance), to a rotate corolla, with anthers most delicately poised in air and opening by terminal pores The two extreme flower-stages require widely different methods of pollination The flower, viewed rightly as being an organ to insure pollination, has been so changed as to function in a new manner In presenting solely the floral evidence of change one is very conscious of presenting but half the story Has *Afzelia* during its history come successively under the influence of one or of several different insect-groups? Have insect-visitants, capable of pollinating the primitive campanulate flowers, failed, thereby forcing the annual species of *Afzelia*, so to speak, to mould their flowers to meet the requirements of other and different insects? Is the utmost extreme of change, as registered in the flowers of *Afzelia pectinata* and *A cassioides*, the furthermost stage toward adaptation to these other insects, or has it been reached as the final result of tendencies once started and which would be carried out, even if they passed beyond the point of chief advantage to the plant? One is convinced that the significance of such floral change will not be realized until we have information of insect-visitors of *Afzelia*, only now it may be suggested that the change from a more closed, and therefore more specialised, flower to a more open and accessible flower might perhaps be associated with the progressive desiccation which has occurred through much of the range of *Afzelia*, and doubtless indirectly decimated the numbers of pollinating insects That the change in method of pollination has been neither toward the transfer of pollen by the wind nor toward its deposition on the stigma of the same flower seems evident, although wind-pollination is suggested by the exserted, delicate and easily vibrated filaments with the anthers opening by distal pores, the stigma remains capitate and sticky, not at all enlarged and plumose, so as to secure drifting pollen, while self-pollination would surely be made more, rather than less difficult, by the anthers becoming exserted and flexuously vibrant

A vegetative character must be mentioned as being also definitely correlated with the floral changes depicted In considering the duration of plants one cannot form a graduated scale such as we have prepared from the four points of flower-structure. But we have consistently found that primitive characters are retained in the group of the Virgatae, all the sufficiently known species of which are perennial, whereas the really more numerous annual species rarely retain any wholly primitive feature. The association warrants the belief that in this genus annual species have been derived from perennial ancestry, and one suspects that the annual habit is here a geologically recent adaptation to meet the conditions of an increasingly xerophytic climate Throughout the Scrophulariaceae, annual species appear repeatedly as descendents of perennial ancestry, that this has been the case in *Veronica* I have already postulated in Rhodora 23 3 1921, while the same might be urged in the case of *Castilleja* and *Gratiola* We shall return to this question again in considering the evolutionary history of *Agalinis*

Having established a positive evolutionary change in *Afzelia* from a flower of "Gerardioid" or more correctly "Agalinoid" structure to a new type, let us compare in other characters the two most extremely developed species, *Afzelia pectinata* and *A. cassioides.* Although they have much in common, we find that there are decided contrasts in the capsules and seeds Comparing these in the two species and passing in review the seeds of all the other annual species of the genus (Text-figs 2, C, and 3, C), we discover that the seeds of *pectinata* and *cassioides* are the most unlike in the whole series In fact, they can only be connected through the seeds of species lower in our scale Considering first such seeds of lower rank, as exemplified in *A laciniata* or *A sinaloana*, we find them to be simple bodies, covered with a seed-coat which is evidently reticulate Such a seed-coat is general through the Scrophulariaceae and in very many other families of plants, and for our group is certainly primitive. But in *A pectinata* the reticulations of the seed-coat have been projected so as to form one or several wings which may even equal the remaining diameter of the seed, while in *A cassioides* all indication of the reticulations has become lost and the seed-body is deeply furrowed In *pectinata* the capsule is hirsute, and in *cassioides* glabrous Following out the association of winged or loosely reticulate seed with pubescent capsule, and of wingless more tightly coated seed with glabrous or nearly glabrous capsule, one finds the clue to a new arrangement of species, which in the seed shows on one side transition from the primitive reticulate state to the seed of *cassioides*, on the other side through species with more loosely honeycombed seed-coat (the Bipinnatisectae) until one reaches the seed of *pectinata*

It seems clear that the species grouped below in the sections (II) Cassioides and (III) Pectinatae have advanced upon independent lines of progress, which in the seeds have reached a wide divergence although in the flower they have followed the closest parallel courses On the phylogenetic chart (Text-fig. 6) the annual species of *Afzelia* have been grouped along two parallel stems, and the relative degree of change from the primitive has been indicated by using as a gauge the dehiscence of the anther,

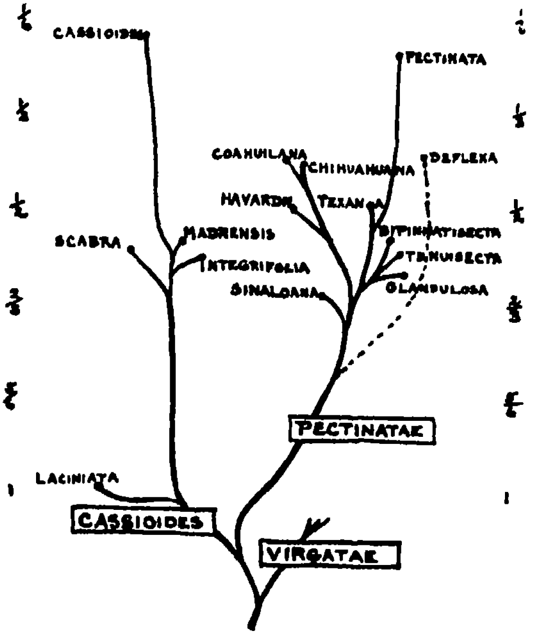

Fig 6 —Phylogenetic chart of the annual species of *Afzelia* The relative "altitude" of the different species has been determined in accord with the diminishing dehiscence of the anther-cells, marginal figures denote the fraction of the cell-length that opens.

perhaps the most sharply distinctive of our several criteria of progress

Now that we have ascertained the direction of evolution within this genus, what of the geographical distribution of the species of *Afzelia?* Do we find any system or homologous progression when we plot upon a map their distributions? In Text-figs 7 and 8 this is done The Virgatae, most primitive in habit, corolla, filaments and anthers, occur in the highlands of central Mexico, from San Luis Potosi and Jalisco to Puebla The subsections of the Cassioides represent three levels of structural progress. (a) the Laciniatae occur in Oaxaca, (b) the Scabrae from Jalisco to western

Texas, (c) the true Cassioides, the most advanced, in the Atlantic Coastal Plain from Louisiana to Florida and North Carolina, and on the Bahamas Similarly the subsections of the Pectinatae show a geographic as well as structural progress, although the Deflexae, comprising one imperfectly known species of Nuevo Leon, show no clear reason for being placed either above or below the Bipinnatisectae The Pectinatae-Bipinnatisectae occur from Sinaloa and Chihuahua to central Texas, while the true Pectinatae, the most advanced, parallel in distribution the true Cassioides, ranging through the Atlantic Coastal Plain from Louisiana to Florida and South Carolina

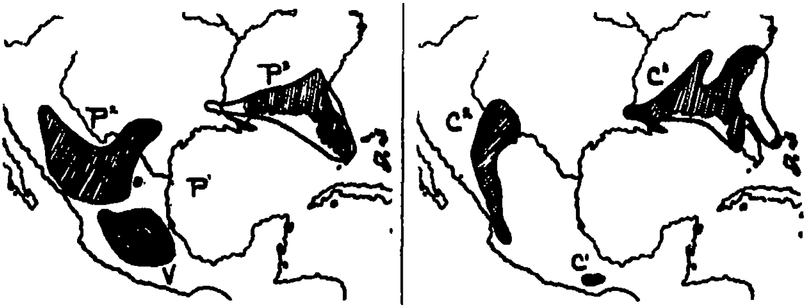

Fig 7 Fig 8

Geographic distribution of the sections of *Afzelia* Fig 7—The Virgatae (V), and the Pectinatae (P)—including the Pectinatae-Deflexae (P^1), Pectinatae-Bipinnatisectae (P^2), and Pectinatae-Pectinatae (P^3) Fig 8—The Cassioides (C)—including the Cassioides-Laciniatae (C^1), Cassioides-Scabrae (C^2), and Cassioides-Cassioides (C^3)

Thus it becomes evident that there is today a definite geographical sequence in the areas of distribution of the species of *Afzelia*, fully paralleling the structural advance presented on our phylogenetic chart Such a sequence seems only explicable on the supposition that the species of each geographic stage represent the state to which *Afzelia* had attained on reaching that region in its definite march from southern or central Mexico northward and northeastward Following back the course of this march we may say that, so far as its own taxonomic evidence can tell us, *Afzelia* first comes to our view historically toward the southern extreme of its present range. From the home of the Virgatae and the Cassioides-Laciniatae, we can see the genus extending to new territories, leaving in conservative species record after record of its structural changes, and at last, in forms florally profoundly transformed, reaching a present ultimate in the Coastal Plain of the southeastern United States It is the annual species which have so migrated, and, most surprising of all, the migration occurred in two streams which have reached today almost the same geographical point

One corollary of this geographical and evolutionary march is how strikingly for *Afzelia* Willis's recent hypothesis of "Age and Area" is refuted The Mexican and Texan species consistently have small ranges, whereas the two most modified and apparently most recent species, *A pectinata* and *A. cassioides*, each cover about as large an area as the combined ranges of all the annual species lower in the scale! In *Afzelia*, as I have already noted in *Veronica*, it is the most modified and recent species which tend to be most wide-spread and are doubtless best adjusted to their present environment On the logic of the "survival of the fittest," should we not expect to find the most recent species to be in such bettered adjustment?

I wonder if we may not explain the limited distribution of the Mexican and Texan species of this genus by simply projecting into the past this idea of adjustment to the environment Today these species,—seven of Virgatae, four of Cassioides, nine of Pectinatae,—each occupies a surprising limited area, and mostly are quite remote one from another (Text-figs 7, 8 and 9) To account for their present isolated distribution one must postulate a greater range for many at some time in the past, probably this combined with the occurrence of other intermediate species which have since died out May we not assume, at least for the annual species of *Afzelia*, that the genus has flourished much more in northern Mexico and Texas during the not remote geological past when this region was moister than it is today, that then the many species were evolved, and that with the onset of the present arid conditions the ranges of these species have shrunken until today each survives over an area that is only a remnant of its former occurrence? Also, unless we place the origin of most of these species well into the past, it becomes difficult to comprehend why they should preserve today so precisely the stages of a structural advance from south to north; although I would not deny that there may have been a secondary formation of recent species in some part of this area, most likely in the mountains of Chihuahua, surely the main species must still remain little changed from the time when the two waves of migration of the Cassioides and Pectinatae passed over this region.

Furthest to the northeast *Afzelia pectinata* is isolated from its Texan allies by seven or perhaps nine degrees of longitude, and *A cassioides* by over ten degrees (Text-figs 9 and 10) Both are isolated structurally from those allies by such profound differences, as almost necessarily to make us believe in the former existence of species intermediate in structure and which occurred in the intermediate areas of Texas *A pectinata* and *A cassioides* are such dominant types as to suggest that they occur in climates which today are especially congenial to this genus, that they represent now the two crests of the northward-moving waves

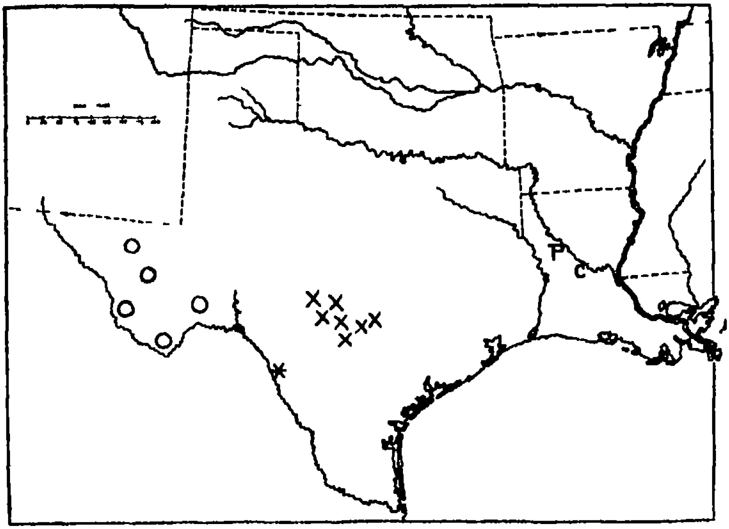

Fig 9 —Geographic distribution of *Afzelia* in the West Gulf states O = *A scabra*, × = *A texana*, * = *A havardii*, C and P denote reputed occurrences in western Louisiana of *A cassioides* and *A pectinata* respectively (these extralimital records need confirmation, as they may possibly be due to erroneous records) The symbols are so placed as to indicate counties from which specimens have been seen

One wonders how great or how slight may be the structural changes which mark new species, and whether such are to be found within colonies of the parent species or come into being when the offspring pass into new environments The geographic march of *Afzelia*, as well as the constant tendency of allied species of whatever genus to occur in distinct environments or areas, suggests that new species come into being when such waves of forward migration enter new environments Do not gaps in structure so great as those just mentioned suggest also that the single steps of advance may have been of appreciable size?

We have spoken of *Afzelia cassioides* and *A pectinata* as ranging through the Atlantic Coastal Plain of the southeastern United States, but the former species occurs also on sandy mountains in northern Alabama, doubtless in extreme northwestern Georgia, and has even been found in southeastern Tennessee The origin of

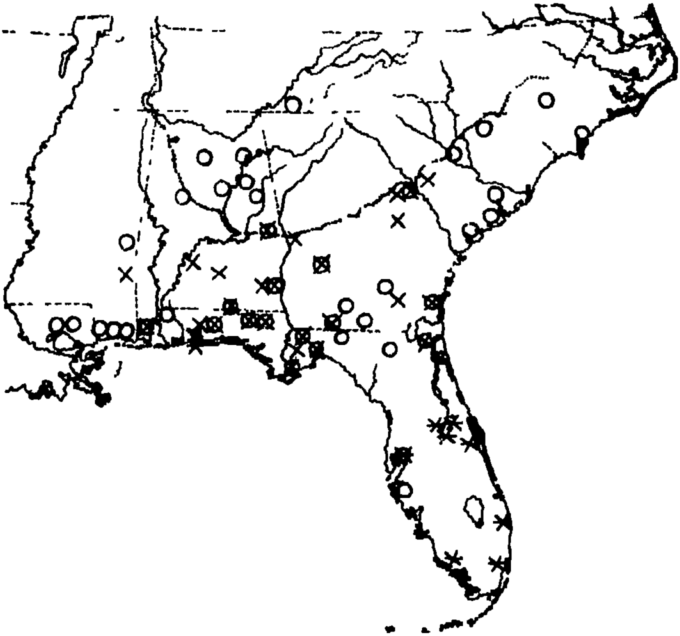

Fig 10 —Geographic distribution of *Afzelia* in the Southeastern states ○ = *A cassioides*, × = *A pectinata*, * = *A pectinata peninsularis* The symbols are so placed as to indicate counties from which specimens have been seen, superimposed symbols denote two species from the same county The irregular dotted line denotes the inner margin of the Coastal Plain

A cassioides is so certainly western, and its path eastward from Louisiana has been so evidently by way of the Coastal Plain as to assure us that the species must have spread in very recent geologic time from the later formations of the Coastal Plain to the older soils of the Appalachian highlands The species is traveling inland by a route of sandstone ridges which has likely been used much more extensively in the reverse direction by plants of the inland that have thus descended to the newer lands toward the coast

Before leaving the theme of the geographic distribution of *Afzelia*, perhaps passing attention should be given to the reported occurrence of this genus in Madagascar That this is erroneous is suggested below where under *A decurva*, its evident synonym *A madagascariensis* is discussed Evidently some intermixture of specimens accounted for the occurrence of a highly distinctive and local Mexican species among the plants which were gathered by Forbes in Madagascar Such was Bentham's surmise in 1835

Seeking now to reconstruct from our evidence the most primitive state of *Afzelia*, one is met by the difficulty that the course of evolution of the annual species depicts clearly an origin from species with seeds unwinged, whereas the Virgatae, in all else apparently primitive, have heavily winged seeds I think we may reconcile the difficulty by supposing that both stocks have been derived from a common ancestry, which was perennial and bore the flowers of the Virgatae, but which had unwinged seeds This would mean that the wing-seeded Virgatae of today are not ancestral to either of the annual groups, though representing most fully the primitive state of the genus The evolution from wingless toward winged seeds seems, moreover, far more probable than would the reverse, inasmuch as the formation of wings to aid the transportation of the seeds by wind seems a positive step toward better adjustment to the environment

The state preserved in *Afzelia laciniata*, annual in habit but with anther-cells dehiscing throughout, would seem to denote that the development of the annual duration of life took place earlier than did the change of flower-structure, and well before the commencement of the march northward beyond central Mexico As already remarked, the annual habit would surely have enabled the species to meet climates of more aridity

A last peculiarly obscure feature remains to be mentioned, but one which strangely enough has originated independently in the two extreme species, *Afzelia pectinata* and *A cassioides* In all the other species of the genus and in *A pectinata* itself the hairs on the stem while often chiefly spreading, yet consistently tend to be reflexed. In the South Florida derivative of the former, *A pectinata peninsularis*, and always in *A cassioides*, these hairs are ascending In fact this constitutes a singularly delicate test for *peninsularis*, but can it in any way be considered as forming a bettered adjustment to the environment? And can any reason be assigned for its having arisen on both evolutionary lines?

As will be more fully stated in "Agalinis and Allies in North America" the first study of this genus was made by the writer while a Harrison fellow in botany at the University of Pennsylvania from 1911 to 1914 Only *Afzelia pectinata* and *A cassioides* have been studied growing and in flower, but nearly all extant specimens of *Afzelia* in American herbaria have been examined A very important help has been the opportunity to examine the historic collections preserved at Kew Gardens, England, generously loaned by the custodians of the herbarium of that institution Finally as with the subsequent paper, I must acknowledge my indebtedness to Prof John M Macfarlane for his oversight and aid while at the University, and to the authorities of the New York Botanical Garden and The Academy of Natural Sciences of Philadelphia, who have enabled me to continue the study more recently

An account of the evolution of the flower of *Afzelia* was presented before the Systematic Section of the Botanical Society of America at the meeting held at Harvard University in December, 1922 The illustrations now used have mostly been adapted from charts prepared for that occasion Although somewhat diagrammatic they represent faithfully each detail of structure

In the paper on *Agalinis* and allies previously referred to, numbered herbarium specimens of *Afzelia* will be enumerated In the present paper also, within the states of the United States, specimens are listed alphabetically by counties, and for each county one collection is more fully cited While in the second paper there will be included a fuller list of herbaria consulted and in which these specimens are preserved, the separate using of the present study makes it advisable now to repeat part of this list The herbaria in which specimens of *Afzelia* have been studied, arranged according to the guide-letters used through the lists under each species below, are:

A—Academy of Natural Sciences of Philadelphia
C—Field Museum of Natural History, Chicago, Illinois.
D—College of Pharmacy, New York City
F—Florida Agricultural College, Gainesville, Florida
H—Gray Herbarium of Harvard University, Cambridge, Massachusetts.
K—Kew Gardens, Kew, England
L—Tulane University, New Orleans, Louisiana
M—Missouri Botanical Garden, St. Louis, Missouri.
N—University of Notre Dame, Notre Dame, Indiana
O—Ohio State University, Columbus, Ohio
P—University of Pennsylvania, Philadelphia

S—Charleston Museum, Charleston, S. C
T—University of Tennessee, Knoxville, Tennessee.
U—United States National Herbarium, Washington, D C
W—Carnegie Museum, Pittsburgh, Pennsylvania.
Y—New York Botanical Garden, New York City.

Specimens of my own collecting have been distributed to some other herbaria not on this list and to which guide-letters will be encountered. The explanation of these will be given in the ensuing paper on "Agalinis and Allies"

AFZELIA J F Gmelin

Afzelia J F Gmel., Syst 927. 1791 Genotype, *Anonymos cassioides* Walt
Seymeria Pursh, Fl Amer Sept 736 1814 Genotype, *S tenuifolia* Pursh, which included the earlier *Anonymos cassioides* Walt The new genus-name was proposed to replace *Afzelia* Gmel , 1791, because of the general adoption of the later *Afzelia* Smith, 1798, for a genus of Papilionaceae

Annual or perennial branched caulescent herbs Stem erect, 2–10 dm tall, minutely puberulent to pubescent, usually glandular Leaves opposite, sessile or short-petioled, entire to pinnatifid or bipinnatifid, glandular-pubescent to glabrous Pedicels ebracteolate Calyx of five united sepals, lobes longer than the tube, entire to dentate Corolla of five united petals; the tube nearly tubular to broadly campanulate, straight or somewhat decurved; the lobes shorter than to longer than the tube, the two posterior more or less united, all spreading or the posterior arched, externally glandular-pubescent or pubescent to glabrous, within pubescent in a ring about the bases of the filaments, and distally pubescent below the posterior sinus or glabrous, membranous, evanescent; yellow, or somewhat tinged or marked with red-purple Filaments four, equal or nearly so, dilated, flattened and pubescent at base (the anterior less pronouncedly so), distally slender and glabrous or rarely lanose, about equaling the corolla-tube. Anther-cells equal, more or less muriculate, glabrous, or rarely with a few apical hairs, each dehiscing by a longitudinal slit extending partially, or tardily entirely, to the base Style slender, straight, deciduous Stigma minute, punctiform to capitate Capsule ovate to urceolate in outline, acute to acuminate, glandular-tomentose to glabrous Seeds ovoid, with a variously modified reticulate testa.

KEY TO THE SPECIES

PERENNIALS. Corolla within thickened, and usually pubescent, below the sinus of the posterior lobes. Anther-cells broadly lanceolate to ovate, 1 8–3 5 mm long. Style less slender Seeds heavily winged —Corolla decurved, the lobes shorter than the tube. Filaments dilated half their length or over, the dilated portion very pubescent laterally Anther-cells opening to the base Capsule ellipsoid-ovate in outline, glandular Plant puberulent with sessile glands (I VIRGATAE)

Corolla pubescent within below posterior sinus Leaves deeply incised (incisions reaching over ¾ distance to midrib), with two to seven pairs of lateral lobes

Calyx-segments lobed or divided.

Corolla 10–12 mm long, the posterior lip densely pubescent medianly quite to the posterior sinus Posterior filaments dilated and pubescent nearly to apex Calyx-segments deeply divided, so as usually to appear to be six to eight in number Leaves 2–3 5 cm long, the mid-blade and segments 1–2 mm wide

Pedicels 20–25 mm long Corolla-throat broadly campanulate and strongly decurved, about 8 mm wide Anterior filaments dilated and pubescent nearly to apex Leaves somewhat bipinnatifid, at least 15 mm wide, glabrate 1 *A latiflora*

Pedicels 5–10 mm long Corolla-throat campanulate and slightly decurved, about 5 mm wide Anterior filaments dilated and pubescent only ¾ their length Leaves pinnatifid or slightly bipinnatifid, 8–10 mm wide, evidently puberulent 2 *A laxa*

Corolla 12–16 mm long, strongly decurved, the posterior lip glabrate just below the posterior sinus Posterior filaments dilated and pubescent about ½ their length, the anterior about ⅓ their length Calyx-segments strongly lobed, but usually clearly only five in number. Leaves 1–2 5 cm long, the mid-blades and segments 0 6–1 mm wide 3 *A decurva*

Calyx-segments entire or nearly so

Corolla 6–8 mm long, its anterior lobes scarcely spreading Posterior filaments dilated and pubescent nearly to apex, the anterior about ⅔ length Plant at least 4–6 dm tall, with many virgately ascending branches 4 *A virgata*

Corolla 9–12 mm long, its anterior lobes spreading or deflexed Anterior filaments dilated and pubescent about ½ length

Capsule acuminate Anterior lobes of corolla loosely spreading Posterior filaments dilated and pubescent about ⅔ length Plant at least 6 dm tall, with numerous loosely spreading and ascending branches 5 *A ramosissima*

Capsule obtuse to acute. Anterior lobes of corolla deflexed-spreading or deflexed Posterior filaments dilated and pubescent ⅔ length Plant 3–4 5 dm tall, with many stems from base, but each stem simple or with few branches. 6 *A stricta*

Corolla glabrous within below posterior sinus Leaves less deeply incised (incisions extending only about ⅔ distance to midrib), with about two to four pairs of lateral lobes Corolla 10 mm long 7. *A pinnatifida*

Annuals Corolla membranous throughout, within glabrous or only slightly pubescent below the sinus of the posterior lobes Anther-cells linear to lanceolate, 3–4 mm long Style filamentous Seeds thin-winged or wingless

Seeds dark, wingless, the seed-coat firm, its reticulations evident or obsolete Capsule urceolate-acute to ellipsoid-lanceolate, glabrous to minutely hirtellous-glandular Plants slightly puberulent to slightly pubescent (II Cassioides.)

Corolla-lobes shorter than to equaling the tube, the two posterior arched and united ⅓ to ⅔ their length Anther-cells opening half their length or more, lanceolate, glabrous Capsule urceolate-ovate to ellipsoid-lanceolate Seeds turgid, not furrowed Pubescence of stem reflexed-incurved Leaves or leaf-segments lanceolate to filiform-linear.

Anther-cells opening nearly or quite throughout Filament-ring and dilated portion of filaments densely pubescent Corolla 9–12 mm long, glabrous below the posterior sinus Calyx-lobes entire to laciniately 3-cleft Seeds pitted Leaves bipinnatifid, the segments filiform-linear with revolute margins Herbage with sessile glands (IIa Cassioides—Laciniatae) 8 *A laciniata*

Anther-cells opening ½ to ⅔ their length Filament-ring and dilated portion of filaments pubescent with shorter hairs Corolla 8 mm long, finely pubescent in a line commencing some distance below the posterior sinus Calyx-lobes entire to dentate Seeds not pitted, the reticulations of the seed-coat evident Leaves with plane margins, the segments wider (IIb Cassioides—Scabrae)

Capsule glabrous Filaments somewhat unequal, the posterior much dilated and strongly incurved, the anterior longer and less dilated Anther-cells lanceolate, 2 2–2 4 mm long Calyx-lobes filiform-linear to linear, entire, glabrous or nearly so Pedicels longer Leaves or leaf-segments linear Stem and pedicels puberulent in lines

Leaves entire or rarely with minute lobes Pedicels 10–12 mm long Posterior lobes of corolla united ½ to ⅔ their length Capsule ellipsoid-lanceolate, not seen mature 9 *A integrifolia.*

Leaves pinnatifid to somewhat bipinnatifid Pedicels 6–8 mm. long Posterior lobes of corolla united ⅓ to ½ their length Capsule urceolate-ovate, 5–6 mm long Seeds 0 6–0 7 mm. long 10 *A madrensis.*

Capsule minutely hirtellous-glandular, 11–12 mm. long Seeds 1 3–1 4 mm. long Filaments nearly equal, the posterior relatively less dilated and incurved, the anterior scarcely less dilated than the posterior Anther-cells narrowly lanceolate, 2.8 mm. long Calyx-lobes lanceolate, dentate, scabrellous-glandular. Pedicels 3–5 mm. long. Leaf-segments lanceolate-linear. Stem and pedicels glandular-puberulent over entire surface. 11. A *scabra*

Corolla-lobes more than twice the length of the tube, the two posterior flattened and united about ⅓ their length. Anther-cells opening by slits extending only ¼ to ⅓ their length, nearly linear, each cell with one or two bristle-like apical hairs. Capsule urceolate-acuminate, compressed distally, glabrous. Seeds 0 5–0 7 mm. long, with five deep longitudinal furrows. Pubescence of stem ascending-incurved. Leaf-segments filiform

(IIc Cassioides—Cassioides)

12 A. *cassioides*

Seeds usually pale, the seed-coat loose, its reticulations becoming raised and then produced into thin wings. Capsule ovate-acuminate to ovate, glandular-pubescent to -tomentose Plants slightly to densely pubescent or hirsute.

(III PECTINATAE)

Distal portion of filaments and the connectives glabrous; filaments 1 5–2 7 mm long, the proximal dilated-pubescent portion of the posterior pair ⅗ to ⅔, of the anterior pair ½ to ⅓ their length. Anther-cells opening ⅓ to ½ their length Capsule ovate-acuminate. Raised reticulations of seed regular or nearly regular, their elevation much less than the remaining diameter of the seed Corolla quite glabrous within below the posterior sinus.

Leaves lanceolate, crenate-dentate. Calyx-lobes entire. Corolla-lobes equaling the tube, spreading-recurved Style 8 mm long Corolla 8 mm. long.

(IIIa Pectinatae—Deflexae)

13 A *deflexa*

Leaves pinnatifid to usually bipinnatifid. Calyx-lobes dentate Corolla-lobes longer than the tube, spreading-ascending. Style 5–7 mm. long.

(IIIb. Pectinatae—Bipinnatisectae)

Anther-cells opening ⅓ to ½ their length. Seeds with reticulations dark-brown, relatively heavy, little raised. Segments of leaf narrowly linear; pinnae remote, relatively short, few-lobed. Plant minutely pubescent to nearly glabrous. Corolla 7.5 mm. long.

14 A *sinaloana*.

Anther-cells opening ¼ to ⅔ their length. Seeds with reticulations paler, lighter, more raised. Segments of leaf linear or broader, pinnae more numerous, closer, usually longer and dentate or lobed

Pedicels 8–16 mm. long Capsule 8–10 mm. long, attenuate-acuminate, about half as wide as long Seeds with reticulations moderately raised Mid-portion of leaf-blades linear or nearly so, mostly 0 5–2 mm wide. Herbage more or less glandular-pubescent

Corolla-lobes oblong, about half as wide as long, uniformly ciliolate, corolla externally glabrous, internally slightly pubescent below postero-lateral sinuses Capsule sparingly glandular-pubescent 15 A *coahuilana.*

Corolla-lobes ovate, often nearly as wide as long, rather sparingly ciliolate; corolla externally glandular-pubescent to glabrate, internally glabrous below all sinuses Capsule strongly glandular-pubescent to -hirsute

Capsule mostly 9–11 mm long, more uniformly tapering from base to apex Leaves slightly bipinnatifid, the middle portion of the blade usually 1–2 mm wide

Pedicels and branchlets sparsely finely pubescent with glandless hairs Corolla externally finely glandular-pubescent to glabrate Capsule glandular-pubescent 16 A. *chihuahuana*

Pedicels and branchlets loosely pubescent with gland-tipped hairs. Corolla externally densely glandular-pubescent Capsule glandular-hirsute 17. A *havardii*

Capsule mostly 8–9 mm long, tapering from a globose body Leaves strongly bipinnatifid, the middle portion of the blade usually 0 5–1 mm wide Herbage glandular-pubescent to -hirsute

Pedicels becoming at least 16 mm. long Corolla 10 mm long. Stem-leaves lanceolate-ovate, 4–5 cm long; the pinnae divaricately spreading, their segments lanceolate 18 A. *bipinnatisecta.*

Pedicels 10–12 mm long Corolla 7–8 mm. long. Stem-leaves triangular-ovate, 1.5–2 5 cm. long; the pinnae falcately spreading, their segments linear

Anterior filaments dilated and pubescent ⅓ to ½ their length; pubescence of filament-

ring and proximal portions of filaments firm and straight Herbage throughout densely glandular-pubescent to -hirsute
19 A *glandulosa*

Anterior filaments dilated and pubescent ¼ to ⅓ their length, pubescence of filament-ring and proximal portion of filaments tenuous and flexuous Herbage finely glandular-pubescent, the stem with appressed glandless hairs also 20 A *tenuisecta*

Pedicels 3–5 (–9) mm long Capsule 6–8 mm long, acute to acuminate, at least two-thirds as wide as long Seeds with reticulations very light and strongly raised Mid-portion of leaf-blades lanceolate or broadly linear, mostly 1 5–4 mm wide Herbage densely glandular-pubescent
21 A *texana*

Distal portion of filaments and the connectives lanose, filaments 3 mm long, the proximal dilated-pubescent portion of the posterior pair ¼, of the anterior pair ⅓ their length Anther-cells opening ⅓ to ¼ their length Capsule ovate Raised reticulations of seed irregularly produced into three or four wings, which may equal the width of the remaining diameter of the seed Corolla 10 mm long, slightly pubescent within below the posterior and postero-lateral sinuses (IIIc Pectinatae—Pectinatae)

Stem lanose to pubescent with reflexed-incurved to -appressed hairs Pedicels 6–7 mm long Capsule densely glandular-tomentose, with hairs dark-jointed but only in part glandular-knobbed at apex Seeds 1 0–1 2 mm long 22 A. *pectinata*

Stem finely pubescent to puberulent in lines with ascending-incurved to -appressed hairs Pedicels 7–10 mm long Capsule less glandular-tomentose to nearly glabrous, with hairs slightly dark-jointed but most or all glandular-knobbed at apex Seeds 1 2–1 4 mm long
22a A *p peninsularis*

1 Afzelia latiflora Pennell, sp nov Text-fig 1, A B

Perennial (?) Stem at least 3 5–4 dm tall, virgately branched, puberulent with retrorse incurved to appressed hairs, and with scattered sessile glands Leaf-blades ovate in general outline, somewhat bipinnatifid, segments broadly linear or narrowly lanceolate, pinnae falcately spreading, mostly falcately lobed; minutely scabro-puberulent above, puberulent on the veins beneath, with scattered sessile glands on both surfaces, those of the stem 2 5–3 3 cm long, 1 4–1 8 cm wide, with six to seven pairs of lateral lobes Pedicels in flower 25 mm long Calyx glandular with sessile or nearly sessile glands, its segments, by the splitting of some nearly or quite to the base, apparently seven or eight, lanceolate, 3–4 mm long Corolla 10–12 mm long, its tube 5 5–6 5 mm long, broadly campanulate proximally, reaching 9–10 mm wide, strongly decurved, its lobes 4 5–6 mm. long, ovate-orbicular, rounded, apparently slightly spreading, the two posterior united to near apex and somewhat arched, externally sparingly glandular with sessile glands, internally pubescent densely in a ring at the attachments of the filaments and also densely below the posterior sinus, the lobes short-ciliate Filaments 2 5 mm long, very stout, all dilated and densely pubescent nearly their entire length, anther-cells 2 5 mm long, lanceolate-ovate, opening to the base Style linear, 5 mm long Capsule 10–11 mm long, ellipsoid-ovate, acute at apex, glandular-puberulent with short-stalked glands, dark-brown Seeds 1 6 mm long, lunate-oval, testa dark, with reticulations heavy, prolonged into two or three thin but firm wings ¼–⅓ width of seed, intra-reticular forming a fine secondary reticulum

Type, probably region of San Luis Potosi, collected in 1878, C C Parry and E Palmer 683, in Herb Academy of Natural Sciences of Philadelphia

Mountains of San Luis Potosi

SAN LUIS POTOSI San Miquelito Mts, Schaffner 735 (K), ——, Parry & Palmer 683 (A, D, H, K, M, U)

2 **Afzelia laxa** Pennell sp nov

Perennial (?) Stem at least 4 dm tall, somewhat branched, puberulent in lines with reflexed incurved hairs, and with few scattered sessile glands Leaf-blades ovate-lanceolate in general outline, pinnatifid or slightly bipinnatifid, segments lanceolate, pinnae spreading, proximal not or slightly lobed, scabro-puberulent and with scattered sessile glands on both surfaces, those of the stem 2 5–3 cm long, 1–1 2 cm wide, with three or four pairs of lateral lobes Pedicels in flower 5–6 mm long, in fruit at least 8 mm long Calyx puberulent with sessile glands, its segments, by the splitting of some nearly or quite to the base, apparently six or seven, lanceolate, 3 mm long Corolla 10 mm long, slightly thickened, its tube 5 5 mm long, tubular-campanulate, somewhat decurved, its lobes 4 5 mm long, ovate, rounded, apparently slightly spreading, the two posterior united ¾ length and arched, externally sparingly puberulent with short hairs and with scattered sessile glands, internally pubescent in a ring at the attachments of the filaments and densely below the posterior sinus, the lobes ciliate Filaments about 2 mm long, stout, the posterior inflexed, strongly dilated and relatively long-pubescent nearly their entire length, the anterior straight, dilated and long-pubescent ¾ their length; anther-cells 3 mm long, broadly lanceolate, opening to the base Style linear, 7–8 mm. long Capsule ellipsoid-ovate (or nearly so), acuminate at apex, glandular-puberulent with probably short-stalked glands, not seen mature

Type, from Mexico, collected in 1848–49, Gregg 410, in Gray Herbarium

Known only from Gregg 410 and Coulter 1280, both lacking precise data

3. Afzelia decurva (Bentham) Kuntze.

Seymeria decurva Benth in DC, Prod 10· 512 1846 "In Mexico (G J Graham!)" Type, Graham 278, collected in 1830 in Mexico (but lacking more precise geographical information), seen in Kew Herbarium.

Afzelia decurva (Benth) Kuntze, Rev Gen 1: 457 1891

Afzelia madagascariensis Kuntze, l c. 457 1891. "B H g p II. 971" The reference is to Bentham & Hooker's Genera Plantarum 2 971 1876, where occurs the following remark. "His addenda species Madagascariensis a Forbesio lecta, foliis fere *S. decurvae*, Benth, floribus *S bipinnatisectae*, Seem, capsula magna" Type, labeled "Madagascar Forbes Herb Soc Hort. Lond 1811," seen in Kew Herbarium. It is certainly *Afzelia decurva* and surely must have come originally from Mexico Such a suspicion was Bentham's on first studying the plant, the Kew specimen bearing the comment "mistaken locality? (was amongst Forbes' Madagascar plants and he never was in Mexico!)," while in Hook. Compan Bot Mag 1 205 1835, Bentham says. "There were specimens . amongst Forbes' Madagascar plants, in the Horticultural Society's herbarium, but I cannot but suspect they must have got there by accident, from some other collection"

Perennial Stem 4–6 dm tall, virgately branched, pubescent with reflexed appressed hairs, among which may be sessile or short-stalked glands Leaf-blades ovate in general outline, more or less bipinnatifid, segments broadly linear, pinnae falcately spreading, the proximal somewhat falcately lobed, scabro-pubescent on both surfaces and with some scattered sessile and short-stalked glands, those of the stem 1–2 cm long, 0 5–1 cm wide, with three to six pairs of lateral lobes Pedicels in flower 8–13 mm long, in fruit 13–16 mm long. Calyx glandular-puberulent with sessile and short-stalked glands and at times somewhat lanose-pubescent; its segments lanceolate, mostly lobed, 5–8 mm. long Corolla 12–16 mm long; its tube 7–9 mm long, tubular-campanulate, strongly decurved, its lobes 5–7 mm long, orbicular-ovate, rounded, apparently slightly spreading, the two posterior united ⅓ length and somewhat arched, externally sparingly puberulent with short-stalked glands, internally pubescent densely in a ring at the attachments of the filaments and also densely below, but not immediately below, the posterior sinus, the lobes rather densely ciliate. Filaments 3 mm. long, very stout; the posterior inflexed, dilated and pubescent ½ their length, the anterior straight, dilated and pubescent ⅓ their length, anther-cells 3.5 mm. long, lanceolate-ovate, opening to the base. Style linear, 8–10 mm. long. Capsule at least 14 mm. long, ellipsoid-ovate, acuminate at apex, densely glandular-puberulent with stalked glands, brownish-black, not seen mature

Mountains, Michoacan to Hidalgo

MICHOACAN Loma Santa Maria (alt 1950 m), near Morelia, Bro G Arsene 5866 (H, M, U), Tlaupujahua, Rose & Hay 5401 (H, U)

MEXICO. Chimalpa, F. Salasar (U), Dos Rios, F Salazar (U)

HIDALGO. Real del Monte, T Coulter 1282 (K)

4. **Afzelia virgata** (Humboldt, Bonpland & Kunth) Kuntze. Text-fig 1, C

Gerardia virgata H. B K., Nov Gen et Spec 2 344 1818 "Crescit prope fodinam Villalpando inter Guanaxuato et Santa Rosa Mexicanorum, alt. 1830 hex" From the present state of Guanajuato Type at Jardin des Plantes, Paris, verified by M Gagnepain, as the plant now considered.
Seymeria virgata (H.B K.) Benth in DC, Prod 10 511 1846
Afzelia virgata (H.B.K) Kuntze, Rev Gen 1 457 1891

Perennial Stem 4–5 dm tall, virgately branched, puberulent with retrorse incurved to appressed hairs and with scattered sessile glands Leaf-blades ovate in general outline, bipinnatifid, segments linear, pinnae spreading, the proximal few-lobed, scabro-puberulent above, and with numerous sessile glands on both surfaces, those of the stem 0 7–1 6 cm long, 0 4–0 7 cm. wide, with three or four pairs of lateral lobes. Pedicels in flower 8–11 mm long, in fruit slightly longer Calyx glandular with sessile glands, its segments linear, entire, 1 5–2 5 mm long Corolla 6–8 mm. long, its tube 3 5–4 5 mm long, tubular-campanulate, strongly decurved, its lobes 2 5–3 5 mm long, orbicular-ovate, rounded, apparently slightly spreading, the two posterior united ¾ to ⅘ length and arched; externally glandular with scattered sessile glands, internally pubescent densely in a ring at the attachments of the filaments, also densely below the posterior sinus, the lobes ciliate. Filaments 1 mm. long, stout, the posterior inflexed, dilated and relatively long-pubescent nearly their entire length, the anterior straight, dilated and pubescent ¾ their length, anther-cells 1 8 mm. long, lanceolate-ovate, opening to the base Style linear, 4 mm long Capsule 8–9 mm long, ellipsoid-ovate, acuminate at apex, densely glandular-puberulent with stalked glands Seeds 1 mm long, oval; testa dark, with reticulations heavy, prolonged into two or three thin but firm wings ⅓–½ width of seed, intrareticular lines forming an irregular secondary reticulum.

Mountains of San Luis Potosi and Guanajuato

SAN LUIS POTOSI San Miquelito Mts., Schaffner 364 (= 735) (C, Y); chiefly in region of San Luis Potosi, Parry & Palmer 682 (A, C, D, H, K, M, U, Y)

GUANAJUATO. Guanajuato, A Duges (H).

5. **Afzelia ramosissima** Pennell, sp. nov

Perennial (?). Stem at least 5–6 dm. tall, virgately widely and laxly branched, pubescent with retrorse incurved hairs and with few obscure sessile glands Leaf-blades ovate in general outline, pinnatifid, segments linear, pinnae spreading, not or scarcely lobed, puberulent and with numerous sessile glands on both surfaces, those of the chief branches 1–2 5 cm long, 0 6–1 2 cm wide, with three to five pairs of lateral lobes Pedicels in flower 7–12 mm long, in fruit slightly longer Calyx puberulent with sessile or nearly sessile glands, its segments entire or nearly so, linear, 3–4 mm long Corolla 9–10 mm long, its tube 5 5–6 mm long, campanulate, slightly decurved, its lobes 3 5–4 mm long, broadly ovate, rounded, loosely somewhat spreading, the two posterior united ⅓ length and somewhat arched, externally sparingly glandular with sessile glands, internally pubescent densely in a ring at the attachments of the filaments and also densely in a wide area below the posterior sinus, the lobes short-ciliate Filaments 1 5–2 mm long, the posterior dilated and pubescent about ⅔ their length, the anterior dilated and pubescent ½ their length, anther-cells 2 5 mm long, broadly lanceolate, opening to the base Style linear, 6–7 mm long Capsule 8 mm long, ovate-conic, acute to acuminate at apex, glandular-puberulent, not seen with seeds

Type, Sierra Madre, west of Bolanos, collected in flower Sept 16, 1897, J N Rose 3708, in United States National Herbarium

Sierra Madre of northern Jalisco

JALISCO Bolanos, Rose 3708 (A, U), on the road to Plateado, Rose 2689 (A, U)

6 **Afzelia stricta** Pennell, sp nov

Perennial Stems, one or several from a thickened woody base, 2–4 dm tall, somewhat virgately branched below, simple or nearly so above Puberulent with retrorse incurved to appressed hairs and sparingly with scattered sessile glands Leaf-blades narrowly ovate in general outline, somewhat bipinnatifid, segments linear, pinnae spreading, the proximal dentate with short lobes, slightly scabro-puberulent above and with scattered sessile glands, those of the stem 1–1 5 cm. long, 0 5–0 8 cm wide, with three or four pairs of lateral lobes Pedicels in flower 10–15 mm. long, in fruit slightly longer Calyx glandular with sessile or nearly sessile glands, its segments entire or nearly so, lanceolate-linear, 3–4 mm long. Corolla 10–12 mm long, its tube 6–6.5 mm long, tubular-campanulate, decurved, its lobes 5 5–6 mm. long, ovate-triangular, rounded, the anterior deflexed-spreading or deflexed, the two posterior united ⅓ length and somewhat arched, externally sparingly glandular-pubescent with stalked glands, internally pubescent densely in a ring at the attachments of the filaments and densely below the posterior sinus, the lobes ciliate Filaments 2 5 mm long, stout, the posterior incurved, dilated and pubescent ⅔ their length; the anterior straight, dilated and pubescent ½ their length; anther-cells 2 7 mm. long, lanceolate-ovate, opening to the base Style linear, 7 mm long Capsule 9 mm long, ellipsoid-ovate, acute at apex, densely glandular-puberulent with stalked glands Seeds 1 3 mm long, oval, testa dark, with reticulations heavy, prolonged into several thin but firm wings ⅓–½ width of seed, intrareticular lines prominent, forming an irregular secondary reticulum

Type, Coxcatlan, Puebla, collected in flower and fruit September, 1909, C A Purpus 4164, in United States National Herbarium

Known only from the type collection

PUEBLA Coxcatlan, Purpus 4164 (A, C, H, M, U, Y)

7 **Afzelia pinnatifida** (Hemsley) Kuntze

Seymeria pinnatifida Hemsl in Biol Cent Amer Bot 2 458 1882 "South Mexico Zimapan (Coulter 1281,) Hb Kew" Type seen in Kew Herbarium

Afzelia pinnatifida (Hemsl) Kuntze, Rev Gen 1 457 1891

Perennial (?) Stem at least 3–4 dm tall, somewhat branched, puberulent in lines with retrorse incurved hairs and with few sessile or nearly sessile glands Leaf-blades ovate in general outline, pinnatifid or slightly bipinnatifid, segments lanceolate to ovate-lanceolate, pinnae spreading, the proximal not or slightly lobed, scabro-puberulent and with scattered sessile or nearly sessile glands on both surfaces, those of the stem 1 5 cm long, 0 8 cm wide, with two to four pairs of lateral lobes (only upper leaves seen) Pedicels in flower 8–15 mm long, in fruit at least 17 mm long Calyx puberulent with short-stalked glands, its segments 3–4 mm long, lanceolate, entire Corolla 10 mm long, its tube 5 5 mm long, tubular-campanulate, somewhat decurved; its lobes 4 5 mm. long, broadly ovate, rounded, apparently slightly spreading, the two posterior united ⅔ to ¾ length and arched, externally sparingly glandular with scattered sessile or nearly sessile glands, internally pubescent densely in a ring at the attachments of the filaments, but glabrous although much thickened below the posterior sinus, the lobes short-ciliate Filaments slightly unequal, stout, the posterior 1 4 mm long, inflexed, strongly dilated and densely relatively long-pubescent nearly their entire length, the anterior 1 8 mm. long, straight, dilated and long-pubescent ¾ to ⅘ their length, anther-cells 2 7 mm long, lanceolate-ovate, opening to the base Style linear, 5–6 mm long Capsule ellipsoid-ovate, acuminate at apex, densely glandular-puberulent with stalked glands, not seen mature

Hidalgo

HIDALGO Zimapan, Coulter 1281 (H, K), 1283 (H, K)

8 **Afzelia laciniata** (Martens & Galeotti) Pennell, comb nov Text-fig 2, I

Gerardia laciniata Mart & Gal , in Bull Acad Brux 12 II 26 1845 "Dans les bois de chênes de la Sierra, au nord d'Oaxaca (Yavezia, Capulapan, etc), a 7,500 pieds Coll H Gal[eotti] No 1070" Isotype seen in Kew Herbarium

Dasystoma laciniata (Mart & Gal) Walp , Repert 6 649 1847

Annual Stem 4–7 dm tall, virgately much branched, sparingly puberulent in lines with retrorse incurved to appressed dark-jointed hairs and with scattered sessile glands Leaf-blades broadly triangular-ovate in general outline, bipinnatifid, segments filiform-linear, channeled above, pinnae divaricately spreading, nearly all cut into filiform pinnules, very sparingly scabrellous above, and with scattered sessile glands on both surfaces, those of the stem 1 5–2 cm long, 1–1 5 cm wide, with four or five pairs of lateral lobes Pedicels in flower 5–10 mm long, in fruit 8–12 mm. long. Calyx roughened with sessile glands, its segments 2 5–4 mm long, linear, entire to laciniately cleft Corolla 9–12 mm long, its tube 4 5–6 mm long, tubular-campanulate, decurved; its lobes 4 5–6 mm long, broadly ovate, rounded, somewhat spreading, the two posterior united ⅔ length and arched, externally glabrous or sparingly glandular, internally pubescent in a ring at the attachments of the filaments, but glabrous below the posterior sinus, lobes nearly eciliate, "sulphur-yellow" Filaments 1.7 mm long, the posterior slightly inflexed, dilated and pubescent ⅔ their length, the anterior straight, less dilated and pubescent ½ their length, anther-cells 3 mm long, lanceolate, opening nearly or quite to the base Style filiform, 5–6 mm long. Capsule 8 mm long, urceolate-ovate, acuminate, glandular-roughened with nearly sessile glands Seeds 0 7 mm. long, lunate-oval, turgid and pitted, testa dark, with reticulations rather heavy and somewhat raised, not winged, intrareticular lines not or scarcely evident

Dry gravelly soil, mountains of Oaxaca. Flowering from September to November

OAXACA Las Sedas, C L Smith 404 (M, U), Oaxaca, H Galeotti 1070 (K), E W D Holway 3721 (C, H), E W. Nelson 1415 (H, U), Reyes, E. W Nelson, 1757 (U); Sierra de San Felipe, C Conzatti 1355 (H), C. G Pringle 5701 (H), Zimatlan, C. Conzatti 1355 (H)

9 **Afzelia integrifolia** (Greenman) Pennell, comb nov

Seymeria integrifolia Greenm., in Proc Amer Acad. Arts & Sci 39 89 1903 "State of Jalisco: on rocky hills near Guadalajara, 18 May 1901, C G Pringle, no 9660 (hb. G.)" Type seen in Gray Herbarium.

Annual. Stem 4–5 dm. tall, virgately much branched, sparingly puberulent in lines with retrorse incurved hairs and with scattered sessile glands Leaf-blades linear, rarely with one or two minute lateral lobes, glabrous; those of the stem 1.2–2 2 cm long, 0.05–0.1 cm wide Pedicels in flower 5–9 mm. long, in fruit 10–12 mm long. Calyx glabrous; its segments 3–3.5 mm. long, linear, entire. Corolla 8 mm long; its tube 4.5 mm. long, tubular-campanulate, strongly decurved; its lobes 3 5 mm. long, ovate, obtusish to rounded, somewhat spreading, the two posterior united ⅔ to ¾ length and strongly arched; externally glabrous, internally pubescent in a ring at the attachments of the filaments, short-pubescent on the posterior surface below, but not just below, the posterior sinus; the lobes ciliolate. Filaments somewhat unequal, relatively slender, the posterior shorter, strongly incurved, much dilated and pubescent ⅔ their length; the anterior 1 5 mm long, straight, much less dilated and pubescent for slightly less than ½ their length, anther-cells 2 2–2 4 mm long, lanceolate, opening ½ to ⅔ their length Style filiform, 5 mm long. Capsule ellipsoid-lanceolate, acuminate at apex, glabrous, not seen mature

Dry rocky soil, mountains of Jalisco Flowering from May to October

JALISCO Etzatlan, C G Pringle 8767 (C, H, K, M, U, Y), Guadalajara, C G Pringle 9660 (H), Sierra de San Estaban, C R Barnes & W J G Land 157 (C)

10 **Afzelia madrensis** Pennell, sp nov

Annual Stem at least 4 dm tall, virgately branched, puberulent in lines with reflexed appressed dark-jointed hairs Leaf-blades triangular-ovate in general outline, pinnatifid or somewhat bipinnatifid, segments narrowly linear to linear, flat to somewhat channeled above, pinnae spreading, some or most with a few short pinnules, sparingly scabrous-puberulent above, glabrous beneath, those of the stem 1 5–2 cm long, 1–1 2 cm wide, with two to four pairs of lateral lobes Pedicels in flower 4–6 mm long, in fruit 6–8 mm. long. Calyx glabrous or nearly so, its segments 2 5–3 5 mm long, filiform-linear, entire Corolla 8 mm long, its tube 4 5 mm long, tubular-campanulate, decurved, its lobes 3 5 mm long, broadly ovate, rounded, somewhat spreading, the two posterior united ⅓ to ¼ length, arched, externally glabrous, internally pubescent in a ring at the attachments of the filaments and short-pubescent on the posterior surface below, but not just below, the posterior sinus, the lobes short-ciliolate Filaments slightly unequal, relatively slender; the posterior shorter, strongly incurved, dilated and pubescent ¾ to ⅔ length, the anterior 1 8 mm long, less dilated and pubescent for slightly less than ½ length; anther-cells 2 2–2 4 mm long, lanceolate, opening ½ to ⅔ their length. Style filiform, 5–6 mm long Capsule 5–6 mm long, urceolate-ovate, acuminate, glabrous, black Seeds 0 6–0.7 mm. long, lunate-oval, turgid, brown, testa dark, with reticulations rather heavy, raised, not winged, intrareticular lines not evident.

Type, Sierra Madre, "N W of Mexico," (in southern Sinaloa or Durango), *collected in flower and fruit* in 1849–50, Seemann 2106; in Herb Hort. Bot Reg Kew

Known only from the type collection

11 **Afzelia scabra** (Gray) Kuntze. Text-fig 9

Seymeria scabra Gray in Torr, Bot Mex Bound 118 1859 "Mountain sides beyond the pass of the Limpio, Wright (448)" Type seen in Gray Herbarium

Afzelia scabra (Gray) Kuntze, Rev Gen 1 457 1891

Annual Stem 2–5 dm tall, virgately much branched, glandular-pubescent to -puberulent with retrorse spreading to incurved stalked glands or hairs Leaf-blades lanceolate-ovate in general outline, scarcely bipinnatifid, segments lanceolate-linear, pinnae spreading, lowest at times toothed or lobed, hirtellous- or scabrellous-glandular with short-stalked glands on both surfaces, those of the stem 1 5–2 cm long, 0 5–1 2 cm wide, with three to five pairs of lateral lobes Pedicels in flower 1 5–4 mm long, in fruit 3–5 mm long Calyx roughened with scattered short-stalked to sessile glands, its segments 3–6 mm long, lanceolate, dentate Corolla 8 mm long, its tube 4 mm long, tubular-campanulate, decurved, its lobes 4 mm long, triangular-ovate, rounded, somewhat spreading, the two posterior united ⅔ to ¾ length and flattened or somewhat arched, externally glabrous, internally pubescent with relatively short hairs in a ring at the attachments of the filaments and diffused on posterior surface below the posterior sinus, the lobes ciliolate Filaments slightly unequal, relatively stout, the posterior shorter, somewhat inflexed, dilated and short-pubescent ⅓ their length, the anterior 1 8 mm long, straight, dilated and short-pubescent ¼ to ⅓ their length, anther-cells 2 8 mm long, narrowly lanceolate, opening ½ to ⅔ their length Style filiform, 4–6 mm long Capsule 11–12 mm long, ellipsoid-lanceolate, attenuate-acuminate at apex, hirtellous-glandular with scattered short-stalked glands Seeds 1 3–1 4 mm long, orbicular-oval, much compressed, testa dark, with reticulations rather heavy, slightly raised, not winged, intrareticular lines delicate and irregular

Hills and mountain-slopes, Trans-Pecos Texas and Chihuahua Flowering in August and September

Texas Brewster Chisos Mts, V Havard (U) Culberson Guadalupe Mts, M S Young (M) Jeff Davis "Limpio," C Wright 448 (A, H, K, M, U, Y) Presidio Chenates region, G C Nealley 351 (C, U) Terrell: Sanderson, E O Wooton (U)

Chihuahua Santa Eulalia Mts, C G Pringle 647 (A, C, D, H, K, P, U, Y)

12 **Afzelia cassioides** (Walter) J F Gmelin Text-figs. 2, II, 9, and 10.

Anonymos cassioides Walt, Fl. Carol 171 1788 No type locality stated, but the plant would be presumably from Berkeley Co, South Carolina. Type, at the British Museum of Natural History, verified by Dr. S F Blake in Rhodora 17 134 1915, as the species now considered

Afzelia cassioides (Walt) J F Gmel, curante L, Syst Nat ed XIII 927 1791

Gerardia afzelia Michx, Fl Bor Amer 2 20 1803 Probably based upon *Afzelia cassioides* (Walt) Gmel, but possibly represented by some specimen of Michaux's collecting in South Carolina and preserved in Paris This not verified, but description distinctive

Gerardia cassioides (Walt) Pers, Syn Pl 2 154 1806

Seymeria tenuifolia Pursh, Fl Amer Sept 737 1814 "In dry sandy woods of Carolina and Georgia v s. in Herb Sherard " Specimen from "Herb Sherard, Oxford," labeled "Gerardia Afzelia Mx," and supposed to have come from Pursh, seen in Herb Academy of Natural Sciences of Philadelphia This is likely an isotype or possibly even the type

Seymeria cassioides (Walt) Blake in Rhodora 17 134 1915

Annual Stem 5–10 dm tall, virgately much branched, glandular-hirsute to sparingly pubescent with ascending incurved dark-jointed hairs and some long-stalked glands Leaf-blades ovate in general outline, bipinnatifid, segments filiform, pinnae falcately spreading, most with filiform pinnules, glandular-hirsute to sparingly hirtellous, channeled above, those of the stem 1–1 5 cm long, 0 8–1 5 cm wide, with four to seven pairs of lateral lobes Pedicels in flower 3–6 mm long, in fruit 4–10 mm long Calyx glabrous or rarely sparingly glandular-hirtellous, its segments 2–2 5 mm long, linear, entire Corolla 9 mm long, its tube 3 mm long, tubular, straight, its lobes 6 mm long, lanceolate, rounded, widely spreading, the two posterior united nearly ½ length, flattened and not arched, externally glabrous, internally pubescent with relatively short hairs in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes sparsely short-ciliolate pale-yellow, more or less purple-marked within the throat and at the bases of the lobes Filaments 2 mm long, the posterior straight distally, strongly inflexed, dilated and pubescent proximally slightly over ¼ their length, the anterior straight throughout, less dilated and pubescent ⅛ to ⅙ their length, anther-cells 3 2 mm long, almost linear, opening ¼ to ⅓ their length, each cell with one or two bristle-like apical hairs Style filiform, 6–8 mm long Capsule 4–4 5 mm long, urceolate-acuminate, compressed distally, black, glabrous Seeds 0 5–0 7 mm long, lanceolate-oblong, plump, testa close, yellowish-brown, with reticulations faint, broken, becoming nearly obsolete, no intrareticular lines, seed with five deep longitudinal furrows alternating with as many ridges

Moist to dry pineland, usually sandy, in the Coastal Plain from North Carolina to Florida and Louisiana, inland to the mountains of northern Alabama and southeastern Tennessee, and on the Bahama Islands Most common in long-leaf pineland Frequent in the Wilmington Pine Barrens, most abundant in the Flat Pinewoods of southern Georgia, northern Florida, and near the Gulf coast to Louisiana, in the Florida peninsula reaching Manatee county, inland casual on sandy or rocky siliceous soil, along the lower Blue Ridge, on Lookout Mountain, on the Warrior Tableland, and in Bradley County, Tennessee; on Great Bahama Island. Flowering in September and October

North Carolina Cumberland: Fayetteville, Biltmore Herb. 4573g (U) New Hanover: Wilmington, Pennell 4900 (C, P)

South Carolina Beaufort Beaufort, Hayden (C). Berkeley: Cooper River, Monks Corner, Pennell 4878 (M, P, U, Y), Otranto, St Johns, Santee Canal, Summerville Charleston: Charleston, Pennell 4866 (P, S). Chesterfield: near Sugarloaf Mt, P H Rogers (A) Richland Columbia, J. D Smith (C, U)

Georgia Coffee , , R M Harper 688 (Y) Colquitt: Moultrie, R M. Harper 1649 (C, H, M, U, Y) Glynn. Thalmann, Pennell 4809 (P) Lowndes: Naylor, Pennell 4743 (P). Richmond: Augusta ,Wray (K) Sumter. Leslie, Pennell 4762 (P) Thomas: Thomasville, Pennell 4725 (M, P)

Florida Columbia. Lake City, P H. Rolfs 457 (C, M) Duval: Jacksonville, A H. Curtiss 1906 (A, C, D, H, K, M, T, U, Y). Franklin. Apalachicola, Pennell 4678 (I, M, P), Fort Gadsden Gadsden: Quincy, River Junction, Biltmore Herb 4573c (U) Hillsboro Tampa, A P Garber (A, C, D, M, N, U) Holmes. Ponce de Leon, Pennell 4653 (G, H, J, K, P, U, Y) Jefferson. Monticello, Pennell 4719 (C, P) Manatee. Bradentown, S. M Tracy 7571 (C, H, M, O, P, U, Y) Okaloosa Milligan, Pennell 4588 (F, N, P) St. John. St. Augustine, M C Reynolds (C, M, P, T, Y). Wakulla: St. Marks, Pennell 4713 (P) Washington. Chipley, Pennell 4649 (P)

Alabama Baldwin: Bay Minette, Pennell 4552 (A, C, H, L, M, P, U, Y) Clay , F S Earle 990 (M, Y) Covington, McRae, Pennell 4639 (—) Cullman , H Eggert (A, M, P) Etowah. Gadsden, Biltmore Herb. 4573b (H, M, U, Y). Henry: Abbeville, F Rugel (Y) Lee: Auburn, F. E Lloyd & F S Earle (Y) Mobile. , C. Mohr (M) Shelby. , M. E Everts (A) Talladega: Talladega, E A Smith (U). Tuscaloosa , C Mohr (T).

Mississippi Harrison: Biloxi, S M. Tracy 3105 (Y). Jackson: Fontainebleau, S. M. Tracy 5109 (C, H, M, U, W, Y), Ocean Springs Lauderdale: Meridian, C. Schuchert (U, Y). Pearl River. Nicholson, T. H. Kearney (U).

Tennessee Bradley. Cleveland, A. Gattinger (T).

LOUISIANA Rapides[1] Alexandria, R S Cocks (L) St Tammany Covington, Pennell 4217 (P) Tangipahoa Hammond, Biltmore Herb 4573d (U)

BAHAMAS Great Bahama Eight Mile Rocks, N L Britton & C F Millspaugh 2457 (U, Y)

13 **Afzelia deflexa** (Eastwood) Pennell, comb nov

Seymeria deflexa Eastw in Proc Amer Acad Arts & Sci 44 607 1909 "Nuevo Leon Limestone ledges of the Sierra Madre above Monter[r]ey, 19 September, 1907, C G Pringle, no 10,398 (type in hb Gray) " Type seen in Gray Herbarium of Harvard University

Annual (?) Stem at least 4 dm tall, much branched, glandular-puberulent with retrorse incurved to appressed hairs and with stout straight short-stalked glands equaling these Leaf-blades lanceolate, crenate-dentate, the lower lobes somewhat crenulate, scabrellous-glandular with sessile or short-stalked glands on both surfaces, puberulent on the veins beneath, those of the stem 2 5 cm long, 0 7 cm wide Pedicels more or less decurved, in flower 5–6 mm long Calyx densely granular-puberulent with short-stalked glands, its segments 2 5–3 mm long, broadly lanceolate, entire, spreading-recurved Corolla 8 mm long, its tube 4 mm long, campanulate, straight or nearly so, its lobes 4 mm long, triangular-ovate, retuse, spreading-recurved, the two posterior united ½ length, approximate but scarcely arched, externally glabrous, internally pubescent densely in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes ciliate Filaments 2 mm long, the posterior strongly inflexed, strongly dilated and relatively long-pubescent proximally ¾ their length, the anterior straight, strongly dilated and long-pubescent ½ their length, anther-cells 3 5 mm long, narrowly lanceolate, opening ⅓–½ their length Style filiform, 8 mm long Capsule ovate, densely pubescent with long-stalked glands, not seen mature

Limestone ledges of the Sierra Madre, Nuevo Leon Flowering in September

NUEVO LEON Monterrey, C G Pringle 10398 (H, U)

14 **Afzelia sinaloana** Pennell, sp nov Text-fig 3, 1

Annual. Stem at least 4 5 dm tall, much branched, minutely puberulent with retrorse incurved to appressed hairs, very sparingly or not at all glandular Leaf-blades lanceolate in general outline, bipinnatifid, segments narrowly linear, pinnae divaricately spreading, short, few-toothed or -lobed, very sparingly puberulent above, not glandular; those of the stem 2–2 5 cm long, 0 6–0 7 cm wide, with four or five pairs of lateral lobes Pedicels in flower 4–6 mm long, in fruit 7–8 mm long Calyx sparingly

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[1] Only record from west of Mississippi River and should be confirmed by subsequent collections.

glandular with long-stalked glands, its segments 4–6 mm long, linear-spatulate, deeply dentate Corolla 7 5 mm long; its tube 3 mm long, narrowly campanulate, straight, its lobes 4 5 mm long, lanceolate-ovate, rounded, widely spreading, the two posterior united ⅔ to ⅘ length, flattened and not arched, externally sparingly glandular with stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes irregularly ciliolate Filaments 1 8 mm long, the posterior strongly incurved, dilated and pubescent ¼ their length, the anterior straight, dilated and pubescent ⅕ their length, anther-cells 3 2 mm long, linear-lanceolate, opening ¼ to ⅓ their length Style filiform, 5–6 mm long Capsule 8 mm. long, ovate-acuminate, glandular-pubescent with stalked glands Seeds 1 mm long, rectangular-oval, slightly compressed; testa dark-brown, with reticulations relatively heavy, slightly raised, uniform, intra-reticular lines short, broken

Type, Cerro Colorado, vicinity of Culiacan, Sinaloa, collected in flower and fruit November 2, 1904, T S Brandegee, in United States National Herbarium

Cerro Colorado, mountains of Sinaloa

SINALOA Culiacan, T S Brandegee (H, U)

15 **Afzelia coahuilana** Pennell, sp nov

Annual Stem at least 7 dm tall, much branched, glandular-puberulent with retrorse incurved to appressed hairs and with scattered long-stalked glands Leaf-blades triangular-ovate in general outline, bipinnatifid, the lowest at times slightly tripinnatifid, segments lanceolate, pinnae falcately spreading, pubescent and glandular with stalked glands on both surfaces, those of the stem 3–4 cm long, 1 3–1 5 cm wide, with five to seven pairs of lateral lobes Pedicels in flower 8–10 mm long, in fruit 11–14 mm. long Calyx sparingly glandular with short-stalked glands, its segments 4–5 mm long, lanceolate-spatulate, dentate-lobed Corolla 9–10 mm long, its tube 3 5–4 mm long, tubular-campanulate, straight, its lobes 5 5–6 mm long, oblong, rounded, widely spreading, the two posterior united ⅓ length, flattened and not arched, externally glabrous, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus but somewhat pubescent below the postero-lateral sinuses, the lobes ciliolate Filaments 1 8 mm long; the posterior strongly incurved, dilated and pubescent ⅔ to ½ their length, the anterior straight, less dilated and pubescent ¼ their length, anther-cells 3 2 mm long, linear-oblong, opening ⅙ to ⅓ their length. Style filiform, 6–7 mm long Capsule 8–9 mm long, ovate-acuminate, sparingly glandular-pubescent with stalked glands Seeds 1 2–1 3 mm. long, oblong-oval, plump, testa pale-brown, with reticulations light, moderately raised, thin, uniform; intra-reticular lines very fine, continuous, forming a fine network

Type, collected in flower and fruit August, 1880, Caracol Mts , 21 miles southeast of Monclova, Coahuila, Edward Palmer 989, in Gray Herbarium of Harvard University

Caracol Mountains and Sierra Madre, Coahuila

COAHUILA Monclova, E Palmer 989 p p , Saltillo, E Palmer 989 p p [E Palmer 989 (A, D, H, K, M, U)]

16 **Afzelia chihuahuana** Pennell, sp nov

Annual Stem 3–5 dm tall, much branched, glandular-puberulent with retrorse incurved to appressed hairs, and with scattered long-stalked glands Leaf-blades lanceolate-ovate in general outline, scarcely bipinnatifid, segments lanceolate, pinnae falcately spreading, pubescent and with stalked glands on both surfaces, those of the stem 1–2 5 cm long, 0 4–0 9 cm wide, with four to six pairs of lateral lobes Pedicels in flower 5–9 mm long, in fruit 8–11 mm long Calyx pubescent and glandular with stalked glands, its segments 3–5 mm long, lanceolate-spatulate, dentate-lobed Corolla 8–9 mm long, its tube 3 5 mm long, tubular-campanulate, straight; its lobes 5 mm long, ovate, rounded, widely spreading, two posterior united nearly ½ their length, flattened and not arched, externally sparingly glandular with long-stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior and lateral sinuses, the lobes rather sparingly and shortly ciliolate Filaments 2 mm long, the posterior strongly incurved, dilated and pubescent ½ to ⅔ their length, the anterior straight, dilated and pubescent ⅔ their length, anther-cells 3 mm long, linear-lanceolate, opening ⅓ to ½ their length Style filiform, 5–6 mm long Capsule 10–11 mm long, ovate-acuminate, glandular-pubescent with stalked glands Seeds 1–1 2 mm long, oval, plump, testa grayish-brown, with reticulations dark, moderately raised (higher than in *A. bipinnatisecta*, less than in *A texana*), and very thin, uniform; intra-reticular lines fine, continuous, forming a fine parallel series (finer than in *A. bipinnatisecta*, coarser than in *A texana*)

Type, Cumbre, southwestern Chihuahua, collected in flower and fruit October, 1885, Edward Palmer 325, in Gray Herbarium of Harvard University

Wooded mountain-slopes, Sierra Madre of southwestern Chihuahua Flowering from August to October.

CHIHUAHUA Cumbre, E Palmer 325 (A, D, H, K, U, Y), Sierra Madre, C G Pringle 1352 (A, C, D, H, K, U, Y), 1669 (Y).

17 **Afzelia havardii** Pennell Text-fig 9

Afzelia havardii Pennell, in Proc Acad Nat Sci Phila. 72 507. 1921 "Type, Eagle Pass, Texas, collected in flower and fruit in 1882, Dr V. Havard, in Herb Academy of Natural Sciences of Philadelphia."

Annual Stem about 4 dm tall, much branched, pubescent with retrorse spreading to incurved hairs and with longer stalked glands Leaf-blades lanceolate to ovate-lanceolate in general outline, slightly bipinnatifid, segments lanceolate, pinnae falcately spreading, glandular-hirsute with long-stalked glands on both surfaces, those of the stem 1 5–1 7 cm long, 0 6–0 8 cm wide, with five to seven pairs of lateral lobes Pedicels in flower 6–10 mm. long, in fruit 7–12 mm long Calyx glandular-hirsute with long-stalked glands, its segments 3–4 mm long, lanceolate, acute, dentate Corolla 7 5–8 mm long, its tube 2 5 mm long, tubular-campanulate, straight, its lobes 5 mm long, ovate, rounded, spreading, the two posterior united ⅓ to ½ their length, flattened and not arched, externally glandular-tomentose with long-stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes irregularly ciliolate Filaments 2 5 mm long, the posterior incurved, dilated and pubescent ⅔ their length, the anterior straight, less dilated and pubescent ⅓ their length, anther-cells 3 mm long, linear-oblong, opening ⅓ their length Style filiform, 4 mm long Capsule 9–12 mm long, narrowly ovate-acuminate, glandular-tomentose with long-stalked glands Seeds 1–1 2 mm long, oval, plump, testa pale-brown, with reticulations light, moderately raised, thin, uniform, intra-reticular lines very fine, continuous, forming a delicate parallel series

Near the Rio Grande, Texas

TEXAS Maverick Eagle Pass, V Havard (A, H)

18 **Afzelia bipinnatisecta** (Seemann) Kuntze.

Seymeria bipinnatisecta Seem, Bot Voy Herald 323, pl 59, 1852–57 "Sierra Madre ["N W of Mexico"], 2102 " Type, collected by Seemann in 1849–50, probably in southern Sinaloa or Durango, seen in Kew Herbarium

Afzelia bipinnatisecta (Seem) Kuntze, Rev Gen 1 457 1891

Annual Stem at least 2–3 dm tall, branched, hirsute-pubescent with spreading to somewhat retrorse incurved hairs and numerous long-stalked glands Leaf-blades lanceolate-ovate in general outline, bipinnatifid, segments lanceolate, pinnae divaricately spreading, most of them somewhat sharply and deeply toothed or shallowly laciniate-lobed, glandular-pubescent with stalked glands on both surfaces, those of the stem 4–5 cm long, 1 5–2 cm wide, with five to seven pairs of lateral lobes. Pedicels in flower 9–15 mm long, in fruit at least 16 mm long Calyx abundantly glandular-pubescent with long-stalked glands, its segments 5–6 mm. long, lanceolate, deeply dentate-lobed Corolla 10 mm long; its tube 4 mm. long, tubular-campanulate, straight, its lobes 6 mm. long, ovate, rounded, widely spreading, the two posterior united ⅓ to ½ their length, flattened and not arched, externally glandular-pubescent with long-stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes sparingly short-ciliolate Filaments 2 5–2 7 mm long, the posterior strongly inflexed, dilated and pubescent ⅔ their length, the anterior straight, dilated and pubescent ⅓ their length, anther-cells 3 5 mm long, narrowly lanceolate, opening ½ to ⅔ their length Style filiform, 5–6 mm long Capsule ovate-acuminate, densely glandular-pubescent with stalked glands, not seen mature

"Sierra Madre, N W of Mexico," probably the mountains of southern Sinaloa or southwestern Durango, known only from the original collection

19 **Afzelia glandulosa** Pennell, sp nov

Annual Stem 3–6 dm tall, much branched, hirsute-pubescent with spreading to somewhat retrorse incurved hairs and abundant long-stalked glands Leaf-blades triangular-ovate in general outline, strongly bipinnatifid, the lowest at times even slightly tripinnatifid, segments linear, sometimes broadly so, pinnae falcately spreading, mostly somewhat toothed or laciniate-lobed, abundantly glandular-pubescent on both surfaces, those of the stem 1 5–2 5 cm long, 1–2 cm wide, with four to seven pairs of lateral lobes Pedicels in flower 3–7 mm long, in fruit 10–12 mm long, densely glandular-pubescent Calyx abundantly glandular-pubescent with long-stalked glands, its segments 4–6 mm long, lanceolate to lanceolate-spatulate, dentate Corolla 7–8 mm long, its tube 3 mm long, tubular-campanulate, straight, its lobes 4–5 mm long, ovate, rounded, widely spreading, the two posterior united ⅓ their length, flattened and not arched, externally glandular-pubescent with long-stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes scarcely or not ciliolate Filaments 1 8 mm long, the posterior strongly inflexed, dilated and pubescent ¾ their length; the anterior straight, dilated and pubescent ⅔ to ½ their length, anther-cells 3 5 mm long, narrowly lanceolate, opening ½ to ¾ their length Style filiform, 6–7 mm long Capsule 7–8 mm long, ovate-acuminate, abundantly glandular-pubescent with stalked glands Seeds 0 8–0 9 mm long, angulate-oval, plump, testa reddish-brown, with reticulations dark, evidently raised, nearly uniform, intra-reticular lines fine, forming an irregular reticulum

Type, Sierra Madre near Chuichupa, Chihuahua, collected in flower and fruit Sept. 16, 1899, C H T Townsend and C M Barber 429, in Gray Herbarium of Harvard University

Sierra Madre, mountains and hills of Chihuahua Fruiting in September and October

CHIHUAHUA Chihuahua, C G Pringle 567 (H); Chuichupa, Townsend & Barber 429 (C, H, K, M, U, Y), La Bufa Mt., C G. Pringle 1552 (C, H, M), San Diego Canyon, M. E Jones (U)

20 **Afzelia tenuisecta** Pennell, sp. nov

Annual (?) Stem at least 4–6 dm tall, much branched, finely pubescent with retrorse incurved to appressed hairs and with spreading long-stalked glands Leaf-blades triangular-ovate in general outline, strongly bipinnatifid, segments linear, pinnae spreading, most more or less toothed or laciniate-lobed, finely glandular-pubescent with stalked glands on both surfaces, those of the principal branches 1 2–1 7 cm long, 0 8–1 1 cm wide, with four to seven pairs of lateral lobes Pedicels in flower 9–10 mm long, glandular-pubescent. Calyx glandular-pubescent, its segments 3–4 mm long, linear, somewhat dentate-lobed Corolla 7–8 mm long, its tube 3 mm long, tubular-campanulate, straight, its lobes 4–5 mm long, ovate-oval, rounded, widely spreading, the two posterior united ⅓ their length, flattened and not arched, externally glandular-pubescent with stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes scarcely or not ciliolate Filaments 2 mm long, the posterior inflexed, dilated and pubescent ⅔ their length; the anterior straight, dilated and pubescent ¼ to ⅓ their length, anther-cells 3 mm long, narrowly lanceolate, opening ½ to ⅔ their length Style filiform, 6 mm long Capsule not seen

Type, base of Mt Mohinora, Chihuahua, eight miles from Guadalupe y Calvo, at 7000–7500 feet (2100–2250 m) altitude, collected in flower August 23–31, 1898, E W Nelson 4854, in United States National Herbarium

Mountains of southwestern Chihuahua Flowering in August and September

Known only from the original collection

21 **Afzelia texana** (Gray) Small. Text-fig 9

Seymeria bipinnatisecta texana Gray in Torr , Bot. Mex Bound 117 1859 "Upper Guadalupe river, etc , *Lindheimer* Lower Rio Grande, *Wright* " Several collections made by Lindheimer seen, but none labeled "Upper Guadalupe river " F Lindheimer 451 or 670, labeled "Pedernales," seen in the Gray Herbarium, may stand as the type

Afzelia texana (Gray) Small, Fl S E Un St 1072, 1338 1903

Annual Stem 4–6 dm tall, much branched, pubescent with retrorse incurved to appressed hairs, and glandular-hirsute with longer spreading to retrorse incurved glands Leaf-blades triangular-lanceolate to triangular-ovate in general outline, strongly bipinnatifid, segments lanceolate, pinnae falcately spreading, lower or most dentate-lobed; glandular-hirsute with long-stalked glands on both surfaces, those of the stem 2–3 cm long, 1 2–2 2 cm wide, with five to eight pairs of lateral lobes Pedicels in flower 0 5–2 (–6) mm long, in fruit 3–5 (–9) mm. long, glandular-pubescent Calyx glandular-hirsute with long-stalked glands; its segments 2–5 mm long, broadly lanceolate-obovate, acutish to obtuse, dentate-lobed Corolla 7 5–8 mm long, its tube 2 5 mm long, tubular-campanulate, straight, its lobes 5 mm long, ovate, rounded, spreading, the two posterior united ⅔ their length, flattened and not arched, externally glandular-tomentose with long-stalked glands, internally pubescent in a ring at the attachments of the filaments, glabrous below the posterior sinus, the lobes irregularly ciliolate Filaments 1 5 mm long, the posterior incurved, dilated and pubescent ⅔ their length, the anterior straight, less dilated and pubescent ½ their length, anther-cells 3 mm long, linear-oblong, opening ⅓ their length Style filiform, 5–6 mm long Capsule 8–9 mm long, ovate-acuminate, glandular-tomentose with long-stalked glands Seeds 1 4–1 5 mm long, oval, plump, testa pale-brown, with reticulations light, strongly raised, nearly uniform, intra-reticular lines very fine, continuous, forming a delicate parallel series

Rocky calcareous soil, Edwards Plateau of central Texas Flowering from July to October

Texas Bexar Comanche Spring, Lindheimer 113 (= 1058) (A, C, H, K, M, P, U, Y), 148 (= 1059) (A, C, H, K, M, U, Y) Comal Fischers Store, E J Palmer 12186 (M) Gillespie Fredericksburg, Pedernales, Threadgill, G Jermy 452 (M, U) Hays San Marcos, S M Stanfield (Y) Kendall Spanish Pass, J Clemens 877 (M) Kerr Kerrville, F W Pennell 10395 (Y) Kimble Junction, E J Palmer 10914 (M)

22. Afzelia pectinata (Pursh) Kuntze Text-figs. I, II, 9 and 10

Seymeria pectinata Pursh, Fl Amer Sept 737 1814 "In South Carolina Catesby v s in Herb Sherard " Type not seen, but description sufficiently distinctive

Seymeria jacksoni Ell , Sketch Bot S C & Ga 2 123 1824 "Sent to me from Louisville, Ga , by Mr Jackson " Type seen in the Elliott Herbarium at the Charleston Museum

Seymeria heterophyl[l]a Raf , New Fl Amer 2 68 1837 "Alabama and Georgia, my specimen from Leconte " Type not known to exist, but specimens from Georgia, collected by Le Conte, and probably isotypes, seen in Herbarium Academy of Natural Sciences of Philadelphia

Afzelia pectinata (Pursh) Kuntze, Rev Gen 1 457 1891

Annual Stem 2–6 dm tall, much branched, glandular-lanose or -pubescent with retrorse incurved to appressed hairs, many of which are dark-jointed, and with numerous sessile glands Leaf-blades triangular-ovate in general outline, pinnatifid or at times the lower bipinnatifid, segments lanceolate, pinnae falcately spreading, only the lower if any lobed, glandular-pubescent with hairs some of which are dark-jointed, and with sessile glands, on both surfaces, those of the stem 1 5–3 cm long, 1–2 5 cm. wide, with three to four pairs of lateral lobes Pedicels in flower 3–5 mm long, in fruit 6–7 mm long Calyx glandular-pubescent with hairs, some dark-jointed, and with sessile glands, its segments 3–4.5 mm long, lanceolate, entire Corolla 10 mm long, its tube 3.5–4 mm. long, tubular, straight, its lobes 6 mm. long, ovate, rounded, widely spreading, the two posterior united ⅓ their length, flattened and not arched, externally pubescent with dark-jointed hairs, internally pubescent in a ring at the attachments of the filaments, slightly pubescent below the posterior sinus and somewhat pubescent below the lateral sinuses, the lobes long-ciliolate, deep golden-yellow, somewhat purple-marked within throat and at the bases of the lobes. Filaments 3 mm. long, the posterior straight, dilated and pubescent ¼ their length, the anterior straight, less dilated and pubescent ⅓ their length, anther-cells 2.5–2.8 mm. long, linear-oblong, at times with a minute apical hair, opening ⅓ to ¼ their length. Style filiform, 5–6 mm. long. Capsule 5–7 mm. long, ovate, compressed-rounded to acute at apex, densely brown-tomentose with dark-jointed hairs, some of which bear small terminal knob-like glands. Seeds 1–1.2 mm. long, angulate-ovate, plump, testa pale brownish, with reticulations light, strongly raised, irregularly produced into three or four thin wings which approach in width or may equal the remaining diameter of the seed, intra-reticular lines exceedingly fine, forming a minute-spaced, alveolar-seeming reticulum.

Dry sandy long-leaf pineland in the Coastal Plain from South Carolina to Louisiana, south through the Florida peninsula to Brevard County. Frequent in southern Georgia, southern Alabama and northern Florida. In the central part of the Florida peninsula passing into the variety *peninsularis*. Flowering from July to October.

SOUTH CAROLINA: Aiken. Aiken, H. W. Ravenel (U).

GEORGIA: Glynn: Brunswick, Pennell 4845 (P, U). Jefferson: Louisville, W. Jackson (S). McDuffie. Thomson, H. H. Bartlett 1094. Muscogee: Columbus, Biltm. Herb. 4574f (U). Richmond: Augusta, Cuthbert 287 (Y). Sumter: , Pennell 4760 (C, P). Thomas: Thomasville, Pennell 4732 (P, U). Ware: Waycross, Pennell 4780 (M, P).

FLORIDA: Brevard: Georgiana, A. A. Baldwin 9 (A, P). Duval: Jacksonville, A. H. Curtiss 1907 (A, C, D, H, K, M, T, U, W, Y); San Pablo, Pennell 4802 (P). Escambia. Santa Rosa Island, S. M. Tracy 6423 (A, C, H, M, U, Y). Franklin: Apalachicola, Pennell 4674 (P), Fort Gadsden, Pennell 4686 (A, P). Gadsden: Quincy; River Junction, Biltm. Herb. 4574c (U). Holmes: Ponce de Leon, Pennell 4656 (C, F, N, P, V). Liberty: , Biltm. Herb. 4574e (U). Okaloosa: Milligan, Pennell 4585 (I, L, M, P). St. John: St. Augustine, M. C. Reynolds (A, C, M, Y), Tocoi. Santa Rosa: Milton, Pennell 4568 (G, H, J, K, P, S, U, Y) Wakulla St Marks, Pennell 4705 (P) Washington Chipley, Pennell 4645 (P)

ALABAMA Butler Bolling, Greenville, Biltm Herb 4574b (U) Covington Florala, Pennell 4630 (P, U, Y, Z) Dale Ozark, Biltm Herb 4574g (U) Henry Abbeville, F Rugel (K, M, Y) Lee Auburn, Earle & Baker 773 (W, Y) Mobile Mobile, C Mohr (M) Wilcox , S B Buckley (Y)

MISSISSIPPI Wayne Waynesboro, C L Pollard 1240 (U)

LOUISIANA Natchitoches[2] Natchitoches, R S Cocks (L)

22a. Afzelia pectinata peninsularis Pennell

Afzelia pectinata peninsularis Pennell, in Proc Acad Nat Sci Phila 71 265 1920 "Type, flat woods, Marco, Lee Co, Florida, collected in fruit July-August, 1900, A S Hitchcock 254, in United States National Herbarium "

Stem 4–6 dm tall, finely glandular-pubescent to -puberulent in lines with ascending incurved to appressed hairs Leaves glandular-pubescent to -puberulent, those of the stem 1–2 cm long, 0 5–0 8 cm wide Pedicels in flower 5 mm long, in fruit 7–10 mm long Calyx-lobes 4 5 mm long Corolla 8 mm long Style 4–5 mm long Capsule minutely glandular-pubescent with hairs slightly dark-jointed, most or all of which bear terminal knob-like glands Seeds 1 2–1 4 mm long Otherwise as in the species

Flat long-leaf pineland or in hammocks, southern peninsular Florida Flowering from June to September

FLORIDA Brevard , A J A Fredholm 5858 (H, U, Y) Dade. Miami, Small & Carter 537 (A, C, Y) Hillsboro Tampa, Henshall 1126 (C) Lake. Eustis, G V Nash 888 (A, C, H, K, M, U, Y) Lee Marco, A S Hitchcock 254 (C, H, M, U, Y) Orange Clarcona, M Meislahn 11 (U), Palm Springs Palm Beach West Palm Beach, J W Harshberger (P) Volusia. Orange City, S C Hood (M)

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[2] Only record from west of Mississippi River and should be confirmed by subsequent collections.

ABSTRACTS OF THE MINUTES OF THE PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

1925

January 13, 1925

Special Meeting, called by the President

Twenty-one persons present Vice-President, Dr Henry Skinner, in the Chair

Dr Witmer Stone made a communication entitled "Ornithology of the New Jersey Coast, with Special Reference to the Study of Birds in Life "

January 20, 1925

Stated Meeting of the Academy

Seventeen members present The President, Dr R A F Penrose, Jr , in the Chair

The resignations of Robert M Coyle and H F C Stikeman, as Annual Members, were accepted

Henry Fairfield Osborn, Jr , was elected a member

Nominations were made for President, Vice-President, Secretary, and Treasurer, to serve from the 1925 February meeting to that of 1926, and of five members of the Board of Trustees, grouped in classes of two to serve one year, two to serve two years, and one to serve three years

February 17, 1925

Annual Meeting of the Academy

Twenty-five members present The President, Dr R A F Penrose, Jr , in the Chair

Reports covering the period from December 1, 1923, to December 31, 1924, were presented by the President, Recording Secretary, Corresponding Secretary, Treasurer, Auditors of the Treasurer's Accounts, Treasurer of the "Manual of Conchology," Curators, Library, and Publication Committee

The following officers and members of the Board of Trustees were elected, to serve until the Annual Meeting of 1926, unless otherwise indicated *President,* R A F Penrose, Jr , *Vice-President,* Henry Skinner, *Secretary,* James A G Rehn, *Treasurer,* George Vaux, Jr *Board of Trustees* to serve one year, George L Harrison, T Chalkley Palmer, to serve two years, Effingham B Morris, Charles B. Penrose, to serve three years, John Cadwalader

The resignations of W W Lamborn, Rev E M Jefferys and John Pim Carter as Annual Members, and of Ann Conrad D'Olier, Franklin D'Olier, Jr , and Helen K D'Olier, Jr , as Junior Members, were accepted

March 17, 1925

Stated Meeting of the Academy

Twenty members present The President, Dr R A F Penrose, Jr , in the Chair

The resignation of William Logan Fox as an Annual Member was accepted

The Board of Trustees presented a report covering the actions taken and appointments made at their organization meeting, held immediately following the Annual Meeting of the Academy on February 17, 1925

The President announced that, following the unanimous recommendation of the Committee on the Joseph Leidy Memorial Award, the Council has approved the selection of Dr Herbert Spencer Jennings, of the Johns Hopkins University, as the recipient of the first Joseph Leidy Memorial Award, in appreciation of his researches upon the Protozoa and the Rotatoria, and in recognition of his broad knowledge and keen understanding of the significance of biological phenomena

The Academy, by the adoption of a motion, approved the action of the Committee on the Joseph Leidy Memorial Award and of the Council

The following individuals were elected members: J Carroll Hayes, William Clay, Anderson Polk, Harold T. Green, and Miss Elizabeth S Trotter

April 21, 1925

Stated Meeting of the Academy

Twenty-two members present The President, Dr R. A F. Penrose, Jr., in the Chair

The qualification of Dr Richard A F Penrose, Jr, as a Benefactor of the Academy, was reported by the Secretary

The Board of Trustees reported the appointment of the Girard Trust Company as Assistant Treasurer to act in the absence or disability of the Treasurer of the Academy

The following tributes to deceased former members of the Council of the Academy and members of the Board of Trustees, adopted by the Council at its meeting of April 7, 1925, were transmitted to the Academy with a recommendation for their incorporation in the minutes of this Academy meeting

CHARLES BINGHAM PENROSE, PHYSICIAN,
1862-1925

By Henry Skinner

Dr Penrose early recognized the value of a firm foundation of education as a useful asset in his career and made splendid use of his opportunities He was a brilliant student at college, and this was evidenced by the attainment of the degrees of A M and Ph D from his Alma Mater, Harvard University In selecting a profession he followed in the footsteps of his able father, a distinguished doctor of medicine As an undergraduate of the Medical Department of the University of Pennsylvania his thirst for accurate information was greatly in evidence, and a keen mind and a retentive memory enabled him to store such knowledge for time of need After the attainment of his medical degree his ability was soon recognized, and his advancement was rapid, and as resident at the Pennsylvania Hospital, surgeon to the same institution, surgeon to the German and Gynecean Hospitals, attested his skill Looking forward to the time he would hold a professorship he studied elocution in preparation, and later succeeded Dr William Goodell as professor of gynecology at the University of Pennsylvania He was honored by membership in the College of Physicians of Philadelphia, the American Philosophical Society, and a fellowship in the American Association for the Advancement of Science, and the University of Pennsylvania conferred on him the honorary degree of doctor of laws As an author his activities were broad and he achieved success, his text book of the diseases of women having run through six editions His literary work was not confined to medicine alone as his scientific contributions included mathematics, physics and zoology As president of the Zoological Society of Philadelphia he did splendid work, and early recognized the value of the study of the diseases of animals in relation to those of human beings In building up the pathological department of the institution he saw the importance of these particular studies Whatever he did was well done, and he was largely instrumental in bringing about the present state laws in relation to public health, which were modernized according to his views His work was always characterized by efficiency, sanity and advanced thought, and in addition he had an attractive personality which endeared him to his friends A profound student of nature, he loved the great out-of-doors, and as its chairman greatly advanced the value of the State Game Commission He always took a warm interest in this Academy and was a member of its Board of Trustees at the time of his death, and served efficiently as a member of the Council for many years He will be greatly missed by his friends and colleagues Humanity was distinctly benefited by his life

THE HONORABLE JOHN CADWALADER

1843-1925

By Richard A. F Penrose, Jr

John Cadwalader was connected with The Academy of Natural Sciences of Philadelphia in various capacities, as a member of the Council, as vice-president, as president, and at the time of his death as a member of the Board of Trustees He was not by profession a scientist, yet his intellectual perception and kindly interest enabled him to grasp the importance of scientific work as indispensable to human progress, and he was always deeply interested in the ideals and the accomplishments of the Academy

His family since early Colonial days in Pennsylvania has been active in public affairs, and the spirit of loyalty, honor and patriotism for their country was always strong among them, with the result that from generation to generation they were eminent among their fellowmen The Honorable John Cadwalader was a worthy descendant from such ancestry He was by profession a lawyer and occupied many important legal positions, but with his great breadth of vision he took part in many other spheres of activity in the City, the State and the Nation. He was prominent not only in his profession but as a statesman, an educator, a financier, and a publicist in many fields. His altruistic nature led him ever to work for others and to think but little of his own welfare and health, until in his eighty-second year he collapsed at the very time that he was performing an important public service

Mr Cadwalader, in addition to his ability in a remarkable diversity of public affairs, was noted for his courteous and considerate manner in dealing with all classes of people He recognized the amenities as opposed to the crudities of life, and had that rare combination of ability and refinement which is fast disappearing in the mad rush of modern materialism The Academy and the whole community have lost a true and loyal friend, a survivor of a passing type of gentleman which was once the spirit and the controlling element in the brilliant days of generations that have passed.

The following individuals were elected members. H S Leach, Albert Laessle and Carl Boyer

May 12, 1925

Special Meeting of the Academy, called by the President

Thirty-three members and six visitors present The President, Dr R A F. Penrose, Jr, in the Chair

The President stated that the purpose of the meeting was to present the first Joseph Leidy Memorial Award to Dr Herbert Spencer Jennings

The history of the award was outlined by Dr Penrose, and the terms of the endowment cited, these providing for the award every three years of a bronze medal together with an honorarium for the "best publication, exploration, discovery or research in the natural sciences, in such particular branches thereof as may be designated " The Committee placed in charge of the selection of a candidate chose to make the first bestowal of the award for pre-eminent research in the lower invertebrates, following which they nominated Dr Jennings for his outstanding work on the Protozoa and on the Rotatoria The fitness of the recommendation for distinguished work in fields in which Leidy was a pioneer was at once recognized, and the Academy unanimously approved the action of the committee

The President formally presented the award to Dr Jennings in the name of the Academy Dr Jennings, in accepting, expressed his appreciation of the award and the honor paid him, the connection of the name of Joseph Leidy with the award making its acceptance a matter of added pleasure

Herbert Spencer Jennings was born at Tonica, Illinois, April 8, 1868. Before attending college, he was for one year assistant professor of botany and horticulture in the State Agricultural and Mechanical College of Texas (1888–1889) He graduated at the University of Michigan in 1893, then studied at Harvard University, holding Morgan and Parker Fellowships from 1895 to 1897; and in 1896 he received his degree of doctor of philosophy from the same university Going abroad, he studied at Jena and at Naples during the years 1896–1897 He received in 1909 the honorary degree of LL.D from Clark University, and in 1918 that of Sc.D from the University of Michigan

As an educator he was assistant in the zoological departments of Michigan and Harvard Universities, then was in 1897–1898 associate professor of botany and bacteriology at the State Agricultural and Mechanical College of Montana, later he served on the staff of Dartmouth College (1898 to 1899), at the University of Michigan as instructor and assistant professor of zoology (1899 to 1903), and in a similar capacity at the University of Pennsylvania (1903 to 1906) He went to Johns Hopkins University in 1906, where he has served as associate professor of physiological zoology, professor of experimental zoology, and at present is Henry Walters Professor of Zoology and director of the zoological laboratory

Dr Jennings was director of the United States Fish Commission's biological survey of the Great Lakes in 1901, and in 1903–1904 was a research assistant of the Carnegie Institution of Washington, conducting investigations at the Naples Zoological Station He is a member of the board of editors of the "Journal of Experimental Zoology," and is associate editor of "Genetics" and of the "Journal of Comparative Psychology " President of the American Society of Zoologists (eastern branch) in 1909, and of the American Society of Naturalists in 1910, Dr. Jennings is also a member of the National Academy of Sciences, the American Philosophical Society, the American Academy of Arts and Sciences, correspondent of the Academy of Natural Sciences of Philadelphia and of the Russian Academy of Sciences, honorary fellow of the Royal Microscopical Society of London, a member of the Society for Experimental Biology and Medicine, fellow of the American Association for the Advancement of Science (and present vice-president of its zoological section) The Walker prize of the Boston Society of Natural History has been conferred upon him twice, in 1896 and in 1907

Among the more noteworthy of his writings and contributions are. The Rotatoria of the Great Lakes (1894), The Rotatoria (1901), Monograph of the Rattulidae (1902), Anatomy of the Cat (with Jacob Reighard 1902), Contributions to the Behavior of Lower Organisms (1904), Behavior of Paramecium (1905), Behavior of the Lower Organisms (1906), Heredity and Variation in Size and Form of Paramecium (1908), Heredity, Variation and the Results of Selection in Difflugia corona (1916), The Wheel Animalcules (Rotatoria) (1918); Life, Death, Heredity and Evolution in Unicellular Organisms (1920); Prometheus, or Biology and the Advancement of Man (1925)

NOVEMBER 17, 1925

Stated Meeting of the Academy

Twenty-six members present The President, Dr R A F. Penrose, Jr , in the Chair

The resignation of Dr Maurice Ostheimer, as a Member, was accepted

The Board of Trustees reported that the buildings of the Academy had been covered by insurance adequate to protect them from loss by fire under the eighty per cent requirements of insurance companies, the premiums for the current year having been contributed by Dr R A F Penrose, Jr The Board also reported the receipt of a contribution of one thousand dollars from the children of the late John Cadwalader, and of a bequest of five thousand dollars from the late Edith Boker, given in memory of Charles S Boker, both amounts having been added to the principal of the General Fund The adoption of a new seal of the Academy was also reported by the Board of Trustees

DECEMBER 15, 1925

Stated Meeting of the Academy

Twenty-four members present Vice-President, Dr Henry Skinner, in the Chair

The resignation of Dr R A F Penrose, Jr, as President of the Academy, was presented It stated that the press of other duties prevented him from giving to that office the attention and time he felt it deserves In accepting the resignation the Academy expressed its appreciation of Dr Penrose's services to the institution in the following

Resolved, That Dr Penrose's resignation as President of the Academy, to become operative upon the election of his successor in February next, be accepted with sincere regret, and that the Academy express its appreciation of his dignified and efficient conduct of the office of President during the past three years, of his unselfish devotion to the interests of the institution and his generous support of its activities. It is the sense of the Academy that it is to the energy and resources of Dr Penrose that a new life has been infused into its activities

The following individuals were elected members Henry S Borneman, Mrs C Reed Cary, Dr John A Detlefsen, Rodolphe Meyer de Schauensee, Dr J R Schramm, Mrs Edward Woolman; *Junior Members*, John Bartram, George Myers

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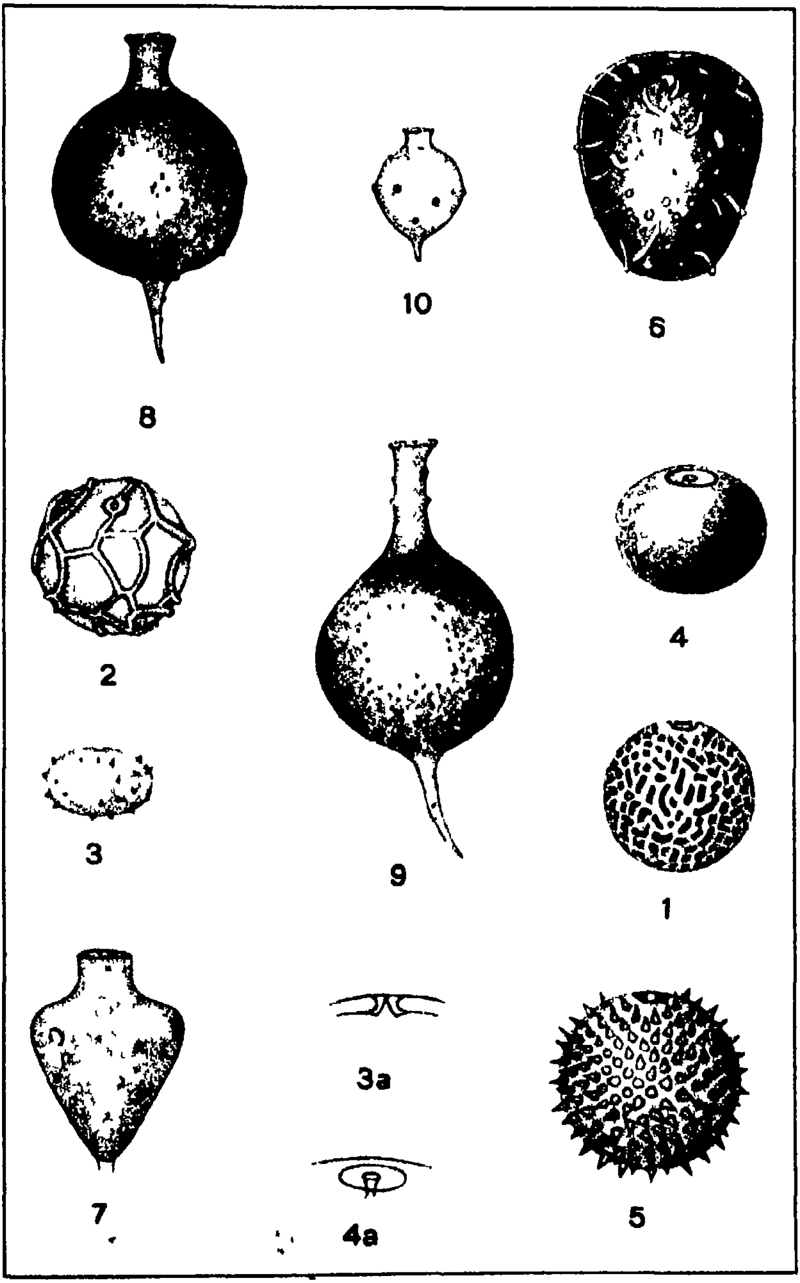

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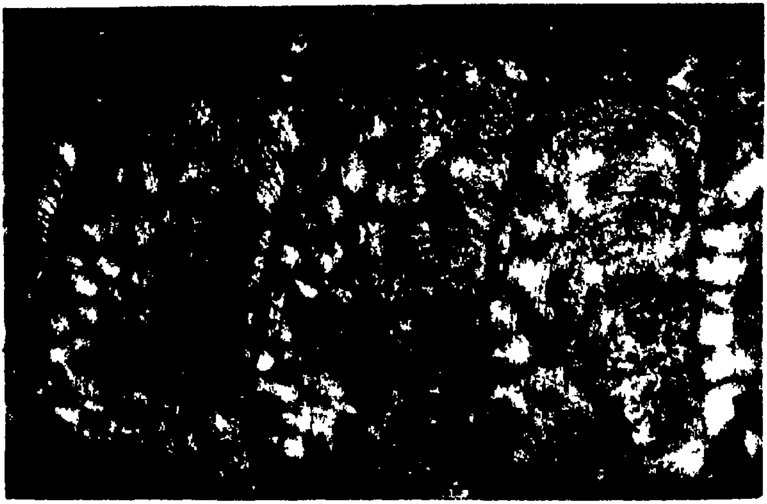

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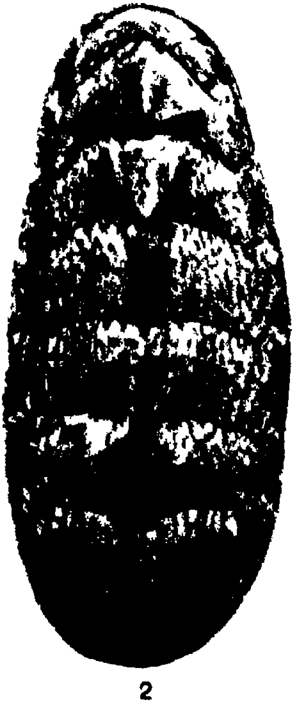

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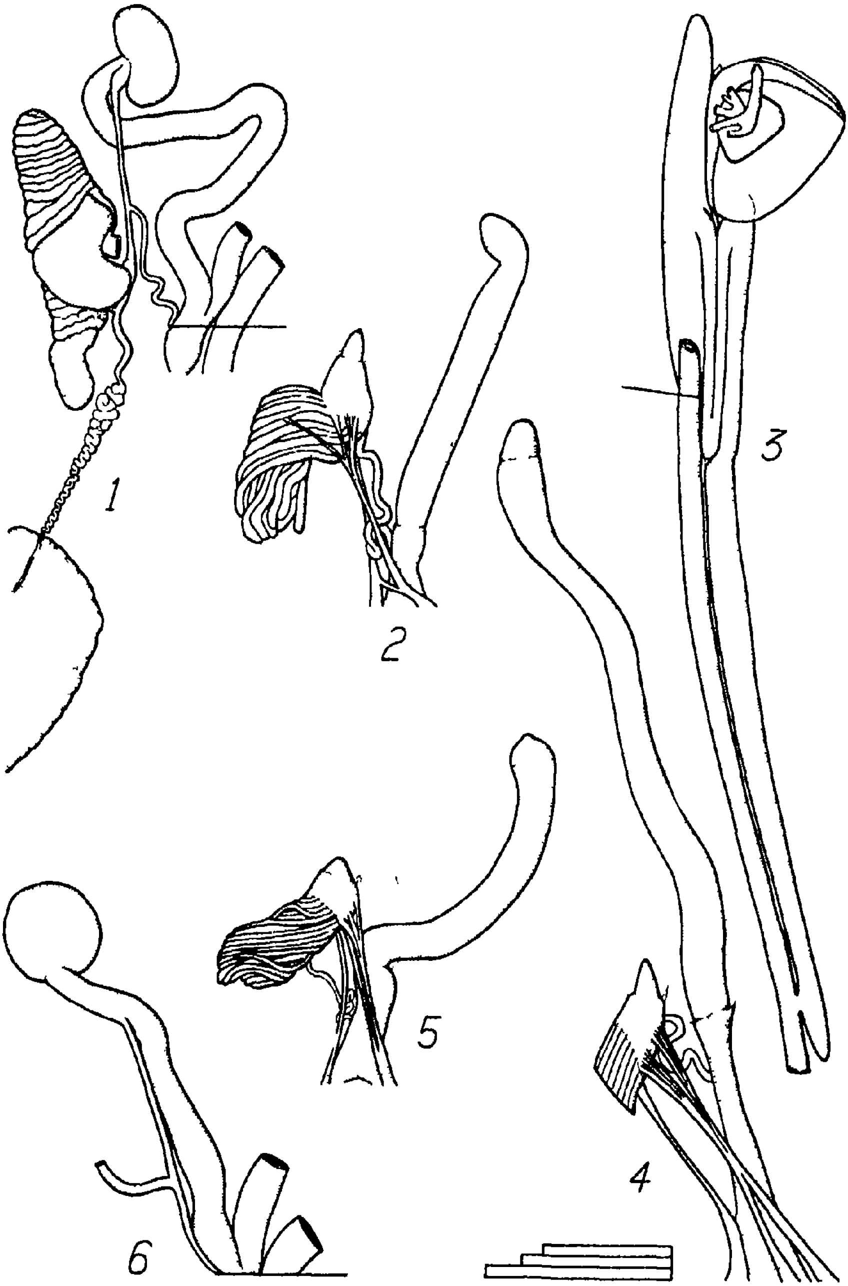

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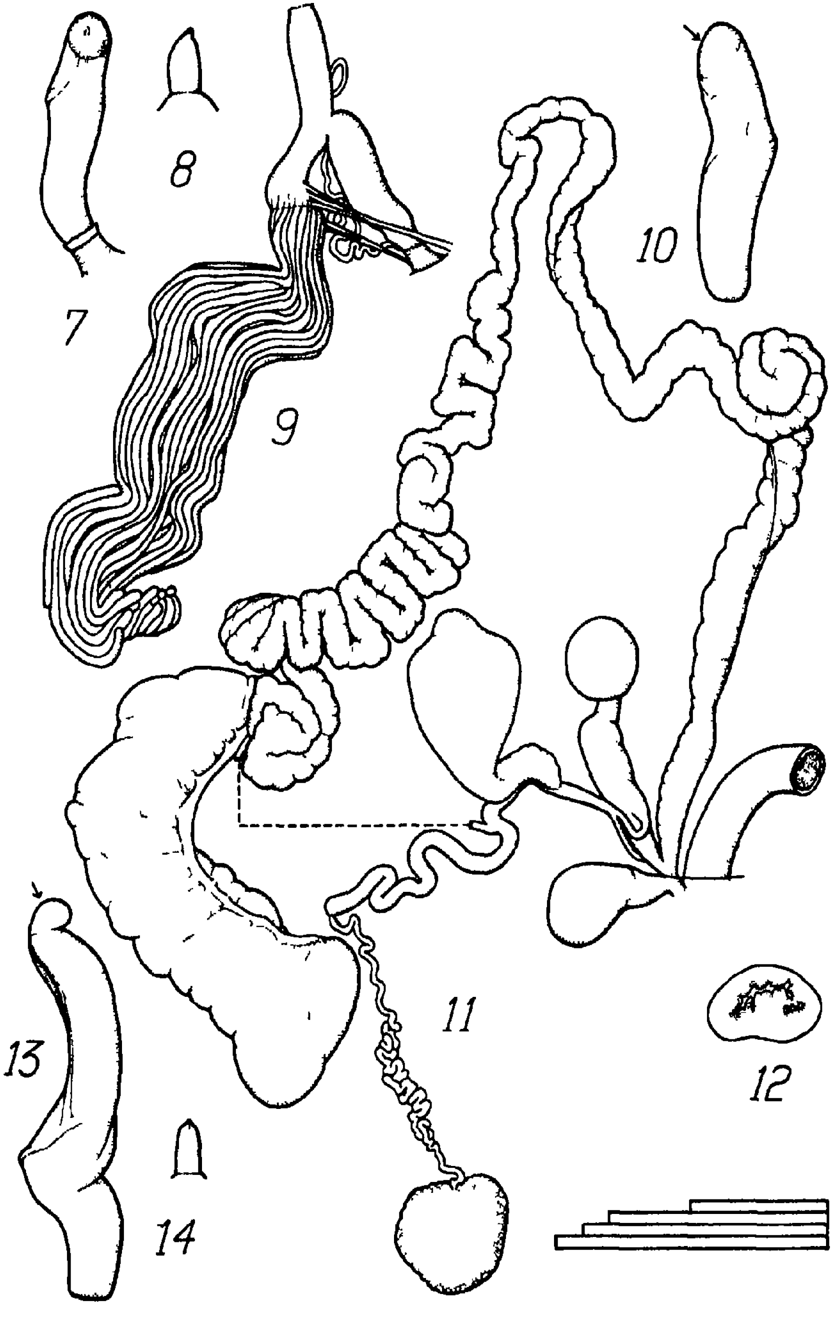

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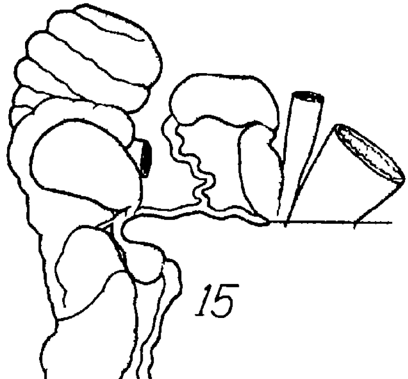

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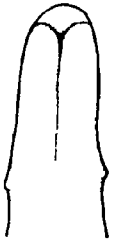

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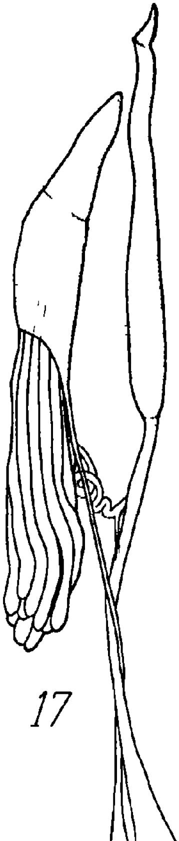

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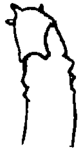

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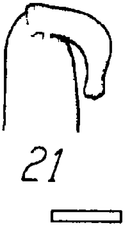

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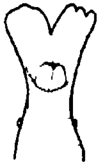

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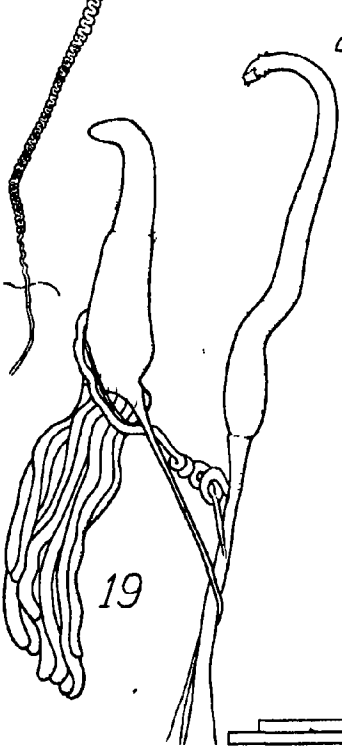

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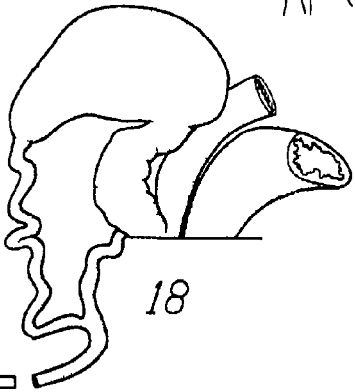

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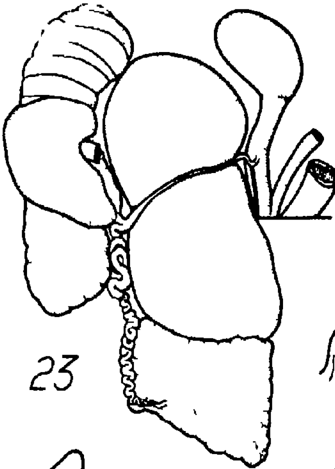

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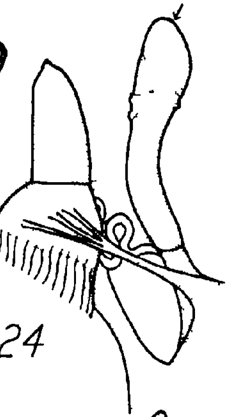

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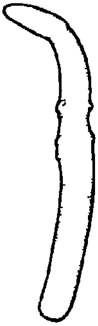

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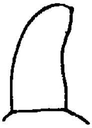

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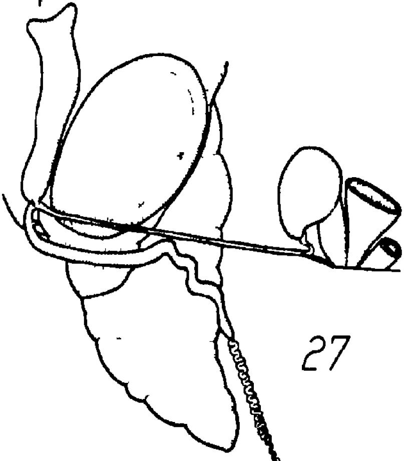

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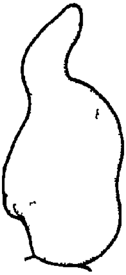

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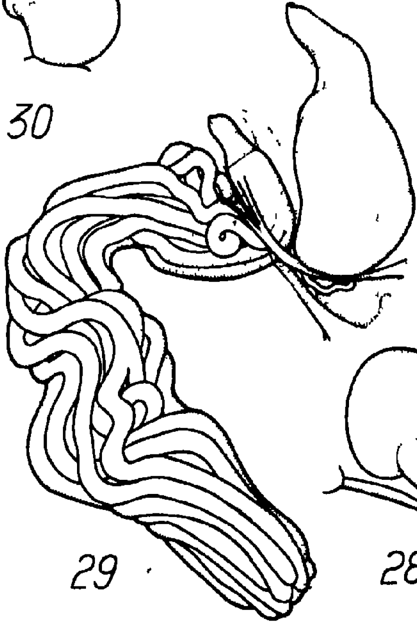

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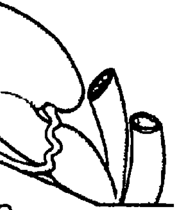

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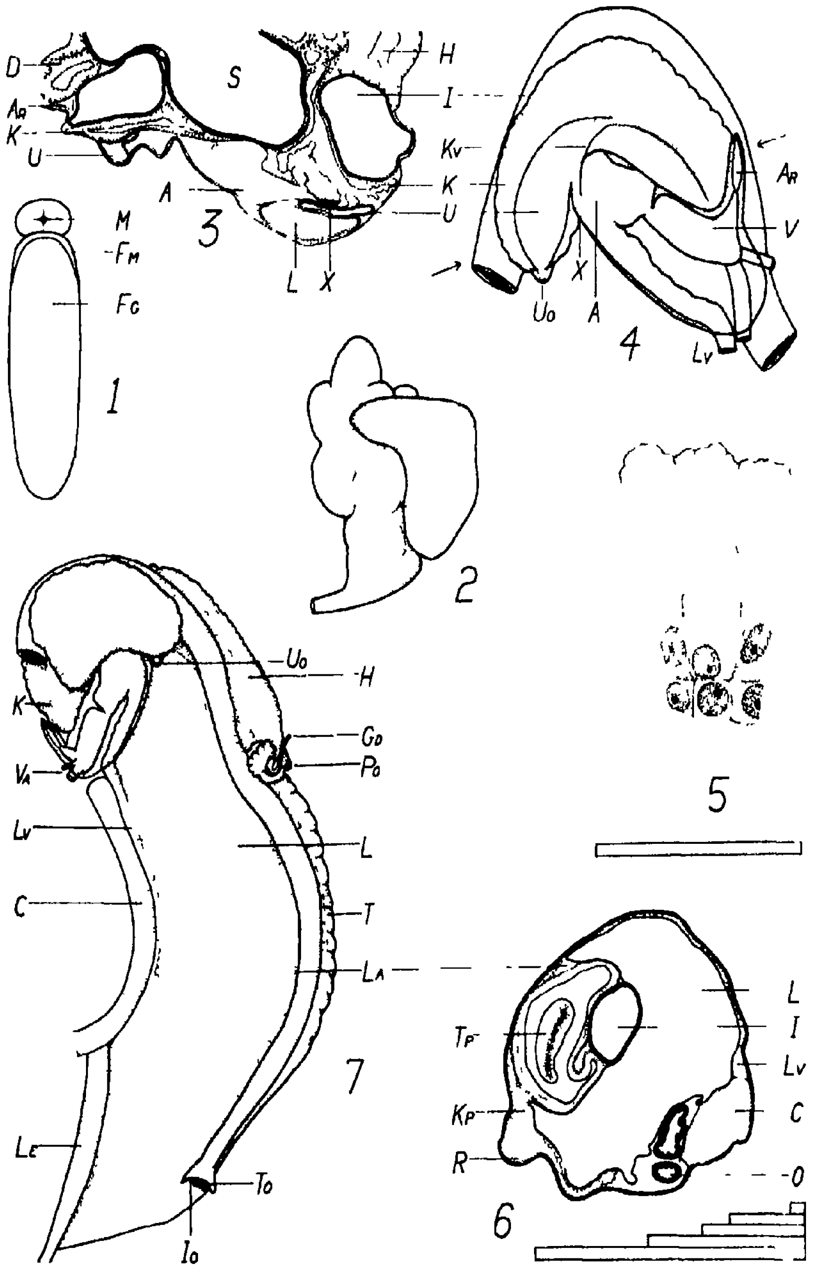

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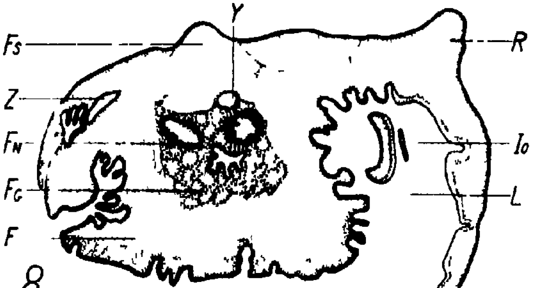

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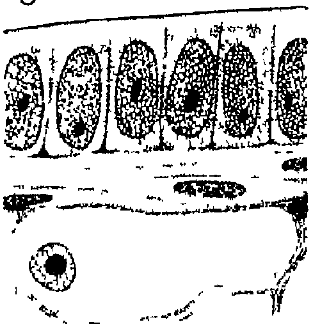

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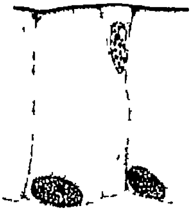

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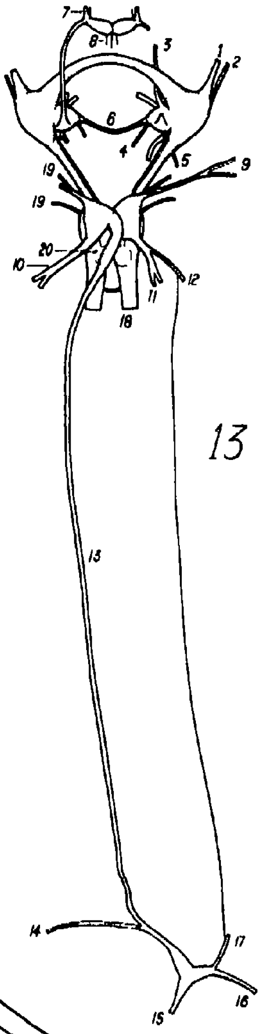

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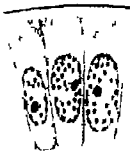

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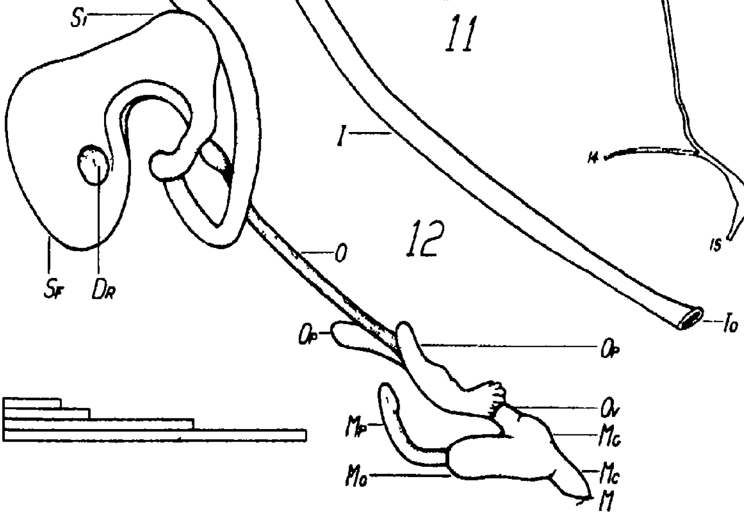

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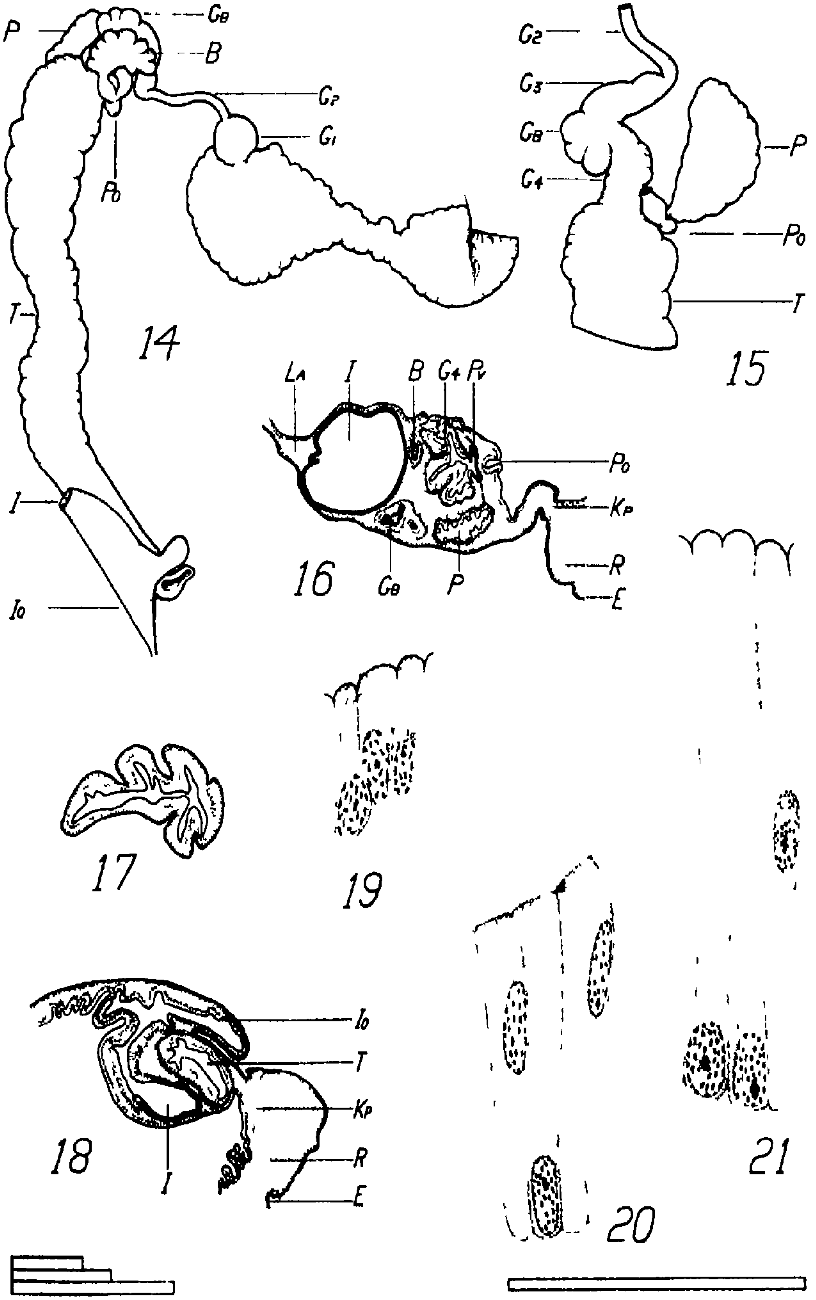

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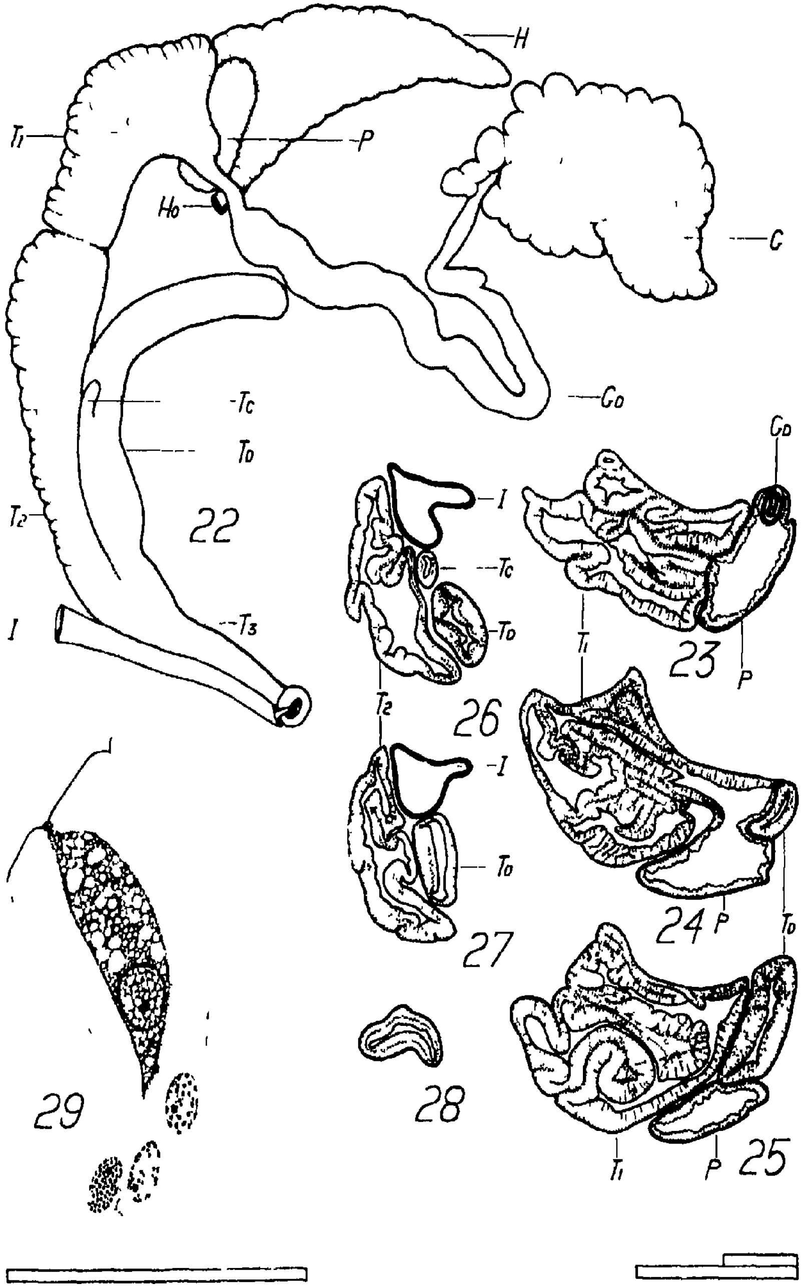

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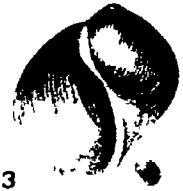
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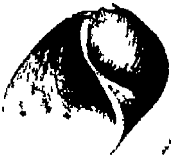
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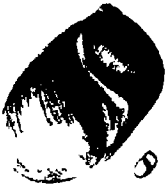
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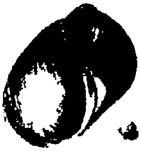
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PILSBRY PHYSA ZIONIS

PROCEEDINGS

OF

The Academy of Natural Sciences

OF

PHILADELPHIA

VOLUME LXXVIII

1926

PHILADELPHIA
THE ACADEMY OF NATURAL SCIENCES
1927

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PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

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PHILADELPHIA

1926

SOUTH AMERICAN LAND AND FRESH WATER MOLLUSKS NOTES AND DESCRIPTIONS,—VI

BY H A PILSBRY

Part of the species described herein were collected by Dr A A Olsson, who has elsewhere[1] given an account of the marine forms taken by him in Peru Others were taken by Mr Russell W Hendee, and sent for identification by Mr William H Weeks of Brooklyn The Bulimulidæ of Dr Olsson's collection will be considered in a future paper of this series Several forms taken by the well-known collector of birds, Mr José Steinbach, are included also

HELICIDÆ

Epiphragmophora multesima n sp Plate I, fig 7

A species of the *E estella* group The shell is rather thin, umbilicate, the width of umbilicus contained eleven times in that of the shell, chamois colored, with a pale-bordered narrow chestnut-brown band above the periphery The surface is glossy, finely malleate-wrinkled spirally The whorls are moderately convex, the last double the width of the penult, broadly rounded peripherally, descending rather deeply and steeply in front The oblique aperture is shortly oval The peristome is very narrowly reflected, upper and basal margins about equally arched, columellar margin dilated at the insertion, covering about a third of the umbilicus, parietal callus thin Height 15 5 mm , diam 26 mm , aperture incl peristome 13 × 15 7 mm 4½ whorls

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[1] Nautilus, Vol 37, p 120–130

Near Saipina, Department of Santa Cruz, Bolivia, elevation about 2000 m Type 129674 ANSP, collected by Mr José Steinback

This species is larger than *E estella* (Orb), less coarsely malleate, and has an open umbilicus

Epiphragmophora clausomphalos (Dev et Hupé)

> *Helix clausomphalos* Deville et Huppe, Rev et Mag de Zool (2), II, 1850, p 658, pl 14, f 2, 2a (cordillères aux environs de Huancavelica)
> *Helix tschudiana* Philippi, Malak, Bl XIV, 1867, p 66, and in Pfr , Novitates Conch III, p 328, pl 79, f 1–3 (Hab propo Huancavelica, Peruviæ)

There appears to be nothing definitely known to separate *H tschudiana* from *H clausomphalos* Von Ihering separates them in his key by a supposed difference in sculpture, but this is merely inferred, as Deville and Hupé did not mention the sculpture of *clausomphalos* Both came from the environs of Huancavelica

Among shells collected by the J B Steere expedition to Peru there is a small form which may be called *E clausomphalus inferior*, figured on Plate I, fig 3. The color is dark olive-buff, with a chestnut-brown band about 2 mm wide about the periphery, a light vinaceous-cinnamon band extends from the suture nearly to the chestnut band, and below the periphery there is a similar but fainter wide band, fading out below. The last two whorls have weak growth-striae and a very fine, evenly developed sculpture of rippled and irregular spiral lines, on the base I count about 18 in one millimeter The whorls increase rather rapidly, the last one descends rather deeply in front The aperture is strongly oblique, truncate-oval, peristome narrowly reflected, white, dilated to form a pad over the umbilicus, upper and outer margins are arched, the basal margin sloping and somewhat straightened, the insertions remote, not converging Height 12 mm., diam. 24½ mm., barely 4 whorls

In one apparently adult shell there is a minute crevice behind the umbilical pad, but in others the margin is closely adnate

Epiphragmophora oroyensis n. sp. Plate I, fig. 2

The shell is imperforate, similar to *E clausomphalos* except that the sculpture consists of very fine growth-lines and, in some examples, weak, fine and inconspicuous spiral malleation on the last part of the last whorl As in *E c inferior*, the umbilical callus may be either wholly adnate or there may be a very narrow crevice (as in the type specimen figured) The glossy surface is olive-buff in various tints beneath, varying shades of cinnamon above The blackish-brown band above the periphery is visible also on the penult whorl Height 15 mm , diam 29 mm , 4½ whorls

Oroya, department of Junin, Peru, 12,000 ft Type 140099 ANSP, and two others, collected by R W Hendee

The status of this form depends upon whether *E clausomphalus* is spirally striate or smooth As no definite information on this point has been published, I am supposing that it has spiral striation as in *Helix tschudiana*, from the same place and presumably identical specifically, also the smaller form, *E c inferior*

Epiphragmophora urubambensis n sp Plate I, fig 5

The shell is umbilicate (umbilicus contained about eight times in the diameter), thin, much depressed, with rounded periphery, composed of 4 moderately convex whorls, the last one about twice the width of the preceding Surface glossy, buff-white, with three bands, the middle one narrow, chestnut-brown, close above the periphery and narrowly exposed on the penult whorl above the suture, the upper and lower bands are wider, cinnamon, the lower one gradually fading into the almost pure white color of the base The first 2 whorls are smooth, the rest very lightly marked with growth-striæ, the last two have a light microscopic sculpture of unequal spiral lines, weak in the peripheral region, strongest around the umbilicus The oblique aperture is regularly oval except for the segment excised by the preceding whorl Peristome is narrowly and evenly reflected, at the columellar insertion dilated a little, covering only a small part of the umbilicus Height 8 6 mm , diam 19 4 mm

Urubamba, Peru Type 83555 ANSP

This appears to be the species figured by Reeve as *Helix diluta* Pfr [2] It is not, I believe the true *H diluta* of Pfeiffer,[3] which is a decidedly more elevated shell with the umbilicus nearly covered by the dilated columellar lip The two species are nearly alike in color and sculpture For comparison, a rather small specimen of *E diluta* (Pfr) is figured, Plate I, fig 4 It is from near Cusco (the type locality) at an elevation of 11,400 ft

Epiphragmophora huancabambensis n sp Plate I, fig 1

The shell is globosely depressed, imperforate, thin but moderately strong Color olive-ochre, with a broad zone of light reddish-brown (between russet and tawny of Ridgway) below the suture, extending nearly to the narrow, chestnut-brown band above the periphery, there is also a small russet area around the umbilical region, fading outwardly into the ground color The surface is glossy, closely malleate throughout, the malleation fine, indistinctly arranged spirally The whorls are weakly convex, the last more than twice the width of the preceding, somewhat dilated towards the aperture, descending rather abruptly in front The strongly oblique aperture is somewhat squarish The peristome is well reflected, white, within it there is a vinaceous-brown band, fading inwardly into the light russet-vinaceous color of the interior, which shows the dark peripheral band bordered with white on both sides The upper margin is slightly arcuate, the basal margin straight, slightly thickened within, dilated and closely adnate over the umbilicus Height 22 3 mm , diam 35 mm , 4½ whorls

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[2] Conchologia Iconica, *Helix*, pl. 106, fig 594

[3] Symbolæ II, p 27; and in Philippi's Abbildungen, *Helix*, p 80, pl 4, fig 11, January, 1844 Described from Paris Mus

Summit of Mt Huancabamba, Peru, about 10,000 ft elevation Type 140098 ANSP, collected by A A Olsson

Epiphragmophora olssoni n sp Plate I, fig 6.

The shell is umbilicate (umbilicus contained about five times in the diameter of the shell), depressed, lens-shaped, angular at the periphery, composed of 4¾ rather slowly and evenly increasing, moderately convex whorls, the last one very slightly descending close to the aperture Color vinaceous-fawn, paler on the spire, a narrow chestnut-brown band with whitish borders above and below, revolves immediately above the periphery and appears above the suture on the penult and half of the next earlier whorl The surface of the first 1½ whorls is smooth, the next whorl lightly striate, the rest closely and rather finely malleate, and indistinctly marked with weak growth wrinkles The aperture is oblique, squarish, the upper and basal margins nearly straight and subparallel, columellar margin very short Peristome is narrowly and evenly reflected throughout Height 15 mm , diam 28 3 mm

Top of Mt Huancabamba, about 10,000 ft elevation Type 140100 ANSP, collected by Dr A A Olsson

This species is related to *E patasensis* (Pfr) and probably also to *E pelliscolubri* (Phil), being similar to them in the depressed shape and the broadly open umbilicus *E olssoni* differs from both by having an angular periphery and by the shape of the basal margin of the peristome, which in a basal view is seen to arch forward

Pleurodonte (Isomeria) gudeana Ancey Plate II, figs 1, 2 3

Pleurodonte gudeana Ancey, Journ de Conchyl 1904, p. 297

The shell is imperforate, depressed-globose, moderately thin, chestnut-brown, becoming chocolate on the spire, and lighter, partly ecru-olive, on the base, glossy The spire is convex, rounded, the first whorl minutely roughened radially, the following one or two whorls irregularly corrugated radially, the corrugations retractive, more or less interrupted The last whorl is lightly striate and densely, very minutely granulose, the granulation close, weak, irregular, subobsolete on much of the base The last whorl is dilated transversely, being shortly elliptical in dorsal or basal view, and descends steeply in front The strongly oblique aperture is somewhat squarish The peristome is rather narrowly reflected, flesh colored, the oblique basal margin becoming white, its inner half strongly calloused within The columellar termination is dilated, forming a pad over the umbilicus Parietal callus thin, transparent Height 15 mm , greater diam 26 mm , smaller diam 20 mm 4 whorls

Colombia, the three specimens were taken either around La Cumbre in the Cordillera Occidental, Department of El Valle, or in the mountains east or west of Popayan, Department of Cauca, by Dr F W Pennell and E P Killip, when collecting plants in 1922

In one specimen the deep brown color prevails over the whole shell An old one collected dead is extensively suffused with golden in flecks and clouds, by the penetration of air

This appears to be the form described and figured by Dunker[4] as a variety of *Helix neogranadensis* Pfr , and thought to be from high mountains of Ecuador Ancey gave the name *Pleurodonte gudeana* to Kobelt's figures, but apparently he had not seen the shell No full description or characteristic figures have been published hitherto, so far as I know

It is somewhat more oblong than *P basidens* (Mousson), from "Bogota " The sculpture of that species is described as "*transversim, praecipue ad suturam, fortiter striata, sub lente lineatim minutissime granulata*", nothing being said of the corrugation seen on our specimens and noticed by Dunker in his "*Helix neogranadensis* Pfr var "

ACAVIDÆ (Strophocheilinae)

Strophocheilus (Borus) intertextus Pils.

This form, described from Corumbá, Brazil, is apparently distinct from *S capillaceus* (Pfr) The heavy texture, snow-white interior, shorter, differently shaped last whorl, the smaller aperture with thick lip and thick parietal callus, are all quite different There are 3½ whorls in the protoconch, the first one nearly flat, smoothish, the rest finely costulate, intercostal intervals smooth except towards the end of the embryonic stage, when some very indistinct and fine granulation in spiral series can be seen in a favorable light No granulation on the later whorls The type specimen, figured in Manual of Conchology, X, pl 17, f 30, 31, measures length 66 mm , diam 42 mm , length of aperture 39 mm , 5½ whorls

---

[4] Jahrbücher d Deutschen Malak Ges IX, 1882, p 377, pl 11, figs 5, 6, copied by Kobelt, Conchyl Cab , Die Heliceen, 4te Abth , p 694, pl 198, figs. 5, 6

Strophocheilus (Borus) kremnoicus vestitus n subsp Plate II, fig 7

The shell agrees with *B kremnoicus* (Orb) in the slender shape and small aperture, scarcely 46 per cent of the length of the shell It differs by being covered with a chestnut cuticle having a few darker streaks, Orbigny's form being habitually denuded, as in *B oblongus*, according to his account After the smooth initial 1½ whorls there are strong, retractive ribs separated by much wider intervals on the next two whorls, after which there are only wrinkles of growth Under the lens, all whorls after the first are seen to be minutely, densely granulose Length 118 mm , diam 58 mm , length of aperture 56 mm 6½ whorls

Bolivia, probably from the Department of Cochabamba Type and paratype 138105 ANSP, collected by José Steinbach

THE SUBGENUS *Chiliborus* AND THE SECTION *Microborus*

The group of Chilean species is rather sharply differentiated from *Borus* proper by the spiral sculpture of the protoconch I propose to segregate these forms in a new subgenus, *Chiliborus*, the type being *Strophocheilus chilensis* (Sowb) [5] Other species of the group are *S rosaceus* (King), *S pachychilus* (Pfr), *S bridgesi* (Pfr) and probably *S crenellus* (Phil) I have not seen the last species

Strophocheilus lutescens and its allies of the eastern coast are not related to this series They appear to be a southern group of *Borus* which may be segregated as section *Microborus*, related to the tropical *S oblongus* group, from which they differ mainly by the small size and weak sculpture of the early whorls The following species belong here

S globosus (v Mart) Southern Uruguay

S lutescens (King), Southern Uruguay Type

S dorbignyi (Doering), Sierra Ventana near Bahia Blanca,

---

[5] This species has been generally known as *Bulimus crenulatus* Pfr *Strophocheilus chilensis* was originally described as *Bulinus chilensis* (see Man. Conch X p 34) This cannot be considered a homonym of *Bulimus chilensis* Lesson (Man Conch XI, p 8) At present the two species are placed in separate families

Argentina Synonym *Bulimus lutescens* var *australis* v Martens, Novit Conch V, 1877, p 23,[*] not *Bulimus australis* Brug

S dorbignyi is considered a species distinct from *lutescens* by Argentine authors While *very close* to *lutescens*, it is somewhat larger and more solid, with a thickened lip, but it differs chiefly by lacking the fine granulation of *lutescens*, or showing only faint traces of it in the most perfect specimens Its area is quite widely separated from that of *lutescens*, and proof of intergradation is lacking

S cordilleræ (Doering), Sierra de Córdoba, Argentina Synonym: *Borus rimanni* Frenguelli, Bol Acad Nac Cienc XXIII, 1918, p 228, text-figs , also XXVI, 1924, p 406, figs 1, 2

BULIMULIDÆ

Plekocheilus onca tenebrosa, n subsp Plate II, figs. 9, 10

Similar to *P onca* (Orb) but larger, more solid, darker colored and rougher Color chestnut-brown, fading to cinnamon-brown towards the outer lip, irregularly and rather sparsely dappled with small, oblong, carob-brown spots, indistinct on account of the general darkness Surface dull, the worn embryonic whorls showing traces of minute, wavy lineolation Subsequent whorls are coarsely striate axially, becoming plicate over much of the last whorl Very superficial but rather coarse spirals may be seen in a favorable light, and in some places a very minute, dense, irregular granulation The aperture is *decidedly wider* than in *P onca*, prussian-red within, fading to a pale lip-edge Outer and basal margins of the lip expanded Columella dilated, colored like the interior Parietal callus thin, transparent Length 76 mm , diam 31 5 mm , length of aperture 43 5 mm 5¼ whorls

Bolivia, Department of Cochabamba Type 138107 ANSP, collected by Mr José Steinbach

Thaumastus insolitus Preston.

A specimen from Rio Tarma at 8500 ft , collected by Mr Russell W Hendee, is longer than the type, measuring 75 5 mm long, 33 wide, aperture 39 mm Up to a length of 68 mm it had the beautiful spiral granulation of the species, but the following growth, about one-third of a whorl, is whitish and roughly wrinkled

Bulimulus (Scutalus) hendeensis new species. Plate II, fig 8

The shell has the shape and general appearance of *B alauda* (Hupé), but the embryonic whorls differ, being more convex, the first one decidedly more elevated There are 2½ embryonic whorls, densely and evenly sculptured with waved and in places anastomosing wrinkles The color pattern is formed of many narrow spiral bands and oblique strokes of dark brown on a whitish ground, preceding growth-rests on the last whorl the pattern is somewhat intensified, and following them dark markings are wanting for a space The striation is coarse but weak, and there is no trace of spiral sculpture The umbilicus is narrow The outer lip is thin, simple and sharp Columellar lip white, reflected The parietal callus is thin and transparent Length 34 mm , diam 18 5 mm , length of aperture 18 mm , 6½ whorls Type Length 36 mm , diam 19 2 mm Paratype, Weeks Coll

---

[*] Professor von Martens noticed his work on *Borus* in the Zoological Record for 1876, but the title-page of Novitates V bears the dates 1877–1879 Probably he had separate copies of his article in 1876

Oroya, department of Junin, Peru, at about 12,000 ft elevation Type 140101 ANSP, collected by Mr Russell W Hendee, and received through Mr W H Weeks

Drymæus weeksi n sp Plate II, fig 4

The shell is umbilicate, acutely ovate, rather thin, white with faint streaks of pinkish-buff conforming to growth-lines, on the antepenult whorl each streak is broken into three spots, the first three whorls being dull pinkish-buff Two embryonic whorls have typical *Drymæus* sculpture, following whorls are finely, irregularly striate, with weakly-impressed spiral lines, indistinct in places On the last whorl the striation grows stronger, the last half having some widely spaced coarse wrinkles, the spiral lines fading out The spire is rather straightly conic, the whorls moderately convex, the last one inflated The umbilicus is compressed The aperture is large, oblique Peristome is thin, broadly expanded and reflected, the columellar margin dilated and flattened Columella straight The parietal callus is moderately thick The aperture and peristome are white Length 45 5 mm , diam 31 mm , length of aperture 31 5 mm 6¾ whorls

Peru, exact locality not known (W H Weeks)

I know of no closely related species *Drymæus expansus* (Pfr.)[7] approaches it slightly in form The broadly exposed outer lip is broken in the type, which Mr Weeks has generously presented to the Academy

ACHATINIDÆ

Synapterpes (*Promoussonius*) pennelli n sp *Plate II, fig 5*

The shell is imperforate, thin, turreted, with very obtuse, rounded apex, covered with a thin chamois-colored cuticle, indistinctly streaked and more or less suffused with brown, somewhat glossy

---

[7] There was an error in the reference to one of the synonyms of *D expansus* in Man Conch XII, p 333, 9th line from bottom, for "idiostylus Rev and Mag." read *idiostomus*, Rev Zool

The first half whorl is smooth, rather weak, curved ribs then appear On the second whorl there are rounded coarse tubercles (or very short, strong folds) below the suture, irregular plication below the suture continuing on subsequent whorls, which are closely rather sharply striate axially, the striæ somewhat festooned or waved by weakly incised spiral lines, which are rather widely spaced, about eight on the penult whorl On the base of the last whorl the striæ become weaker The spire tapers regularly, all of the whorls are slightly convex The aperture is irregularly ovate, white within Outer lip thin and sharp, regularly arcuate The columella is vertical, with reflected and appressed margin, terminating in an oblique truncation well above the base of the aperture Length 27 8 mm, diam 11 mm, length of aperture 12 mm 6½ whorls

Colombia collected in the mountains near Popayan, Department of Cauca, or in the Cordillera Occidental near La Cumbre, Department of El Valle Type 132451 ANSP

This species is strongly differentiated from *S incerta* (Mousson) by the subsutural plication, the narrower contour and the distinctly truncate columella, with more widely reflected edge Named for Dr Francis W Pennell, who collected a single entire specimen and several broken ones in the course of his botanical expedition of 1922

CLAUSILIIDÆ

The sixty-four American species of this family are now classified in three genera, *Nenia*, *Peruinia* and *Temesa*, most of them being comprised in *Nenia* Several subgenera or sections have been proposed by Polinski who has made notable additions to our knowledge of the genus A few others will probably prove useful We have now the following arrangement of American Clausiliidæ

Genus TEMESA H & A Ads Type *T clausilioides* (Rve)
  Synonym *Exbalea* Jousseaume Type *T peruviana* (Pfr)
Genus NENIA H & A Ads Type *N tridens* (Chemn)
  Subgenus *Nenia* proper Same type
    " *Steatonenia*, n subg[8] Type *N cooki* Pils
    " *Neniops*, n subsp[9] Type *N magistra* (Sowb)
    " *Columbinia* Polinski Type *N columbiana* Polin

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[8] *Steatonenia*, new subgenus With the system of sculpture and the strong apertural lamellæ of *Nenia* proper, the shell is very obese in figure with the spire entire, of few whorls. In the type, *N cooki* Pils, (Nautilus, vol 32, p 80) the ratio of diameter to length is about 1 2 5 6 whorls.

N. tridens when not truncate has an extremely peculiar, slender embryonic shell, set awry upon the following whorl, and entirely unlike the embryonic shell of *Steatonenia*

[9] The subgenera *Nenia* proper and *Steatonenia* have coarse axial or *protractive* ridges, but in *Neniops* there are much finer riblets which are *retractive*, mostly more so than the growth-lines,

Section *Gonionenia*, n sect Type *N dohrni* (Pfr)
Subgenus *Gracilinenia* Polinski Type *N filocostulata* (Lub)
" *Incania* Polinski Type *N chacaensis* (Lub)
" *Andinia* Polinski Type *N taczanowskii* (Lub)
" *Neniatracta*, n subg Type *N belahubbardi* Pils
" *Steereana* Jousseaume Type *N steereana* (Sykes)
Genus PERUINIA Polinski Type *P peruana* (Trosch)

Polinski has called attention to the peculiar relation of the spiral lamella to the superior lamella in *Peruinia* In typical *Nenia* and the subgenera *Steatonenia*, *Neniops*, *Columbinia*, *Incania* and *Gracilinenia* the superior is continuous with the spiral lamella, either directly or with a slight bend at their junction *Andinia*, *Neniatracta* and *Steereana* more or less closely approach the condition found in *Peruinia*, the spiral lamella revolves peripherad of the superior lamella, and its anterior end curves strongly towards the axis to meet the latter, which usually projects inward more or less beyond the junction

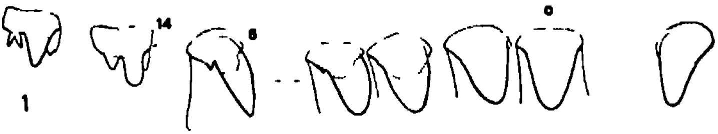
The groups having this structure are distinguished thus

a Spiral sculpture developed, spiral lamella becoming very low as it approaches the superior lamella Dentition peculiar
Genus *Peruinia*
a' Without spiral sculpture Dentition normal (*Neniæ*)
  b Spiral lamella passing in a curve into the superior lamella
    c Sculpture coarse, irregular, form stout.
    Subgenus *Andinia*
    c' Sculpture rather fine, regular, form slender
    Subgenus *Neniatracta*
  b' Spiral and superior lamellæ widely discontinuous
  Subgenus *Steereana*

Peruinia is thus not especially differentiated from some other groups in structure of the lamellæ, but as Polinski has shown, it has a very peculiar type of teeth, recalling some of the arboreal snails So far as known, it has a useful shell character in the engraved spiral lines

It has been seen that the subgenus *Steereana* has lamellæ somewhat similar to those of *Peruinia*, but the two lamellæ are not connected In its dentition, *N* (*Steereana*) *steereana* differs widely The teeth are drawn in Text-fig 3 The central and seven inner lateral teeth are unicuspid, the cusps broad, and as long as the basal plates or longer The outer laterals have an ectocone In the 15th tooth the entocone appears high on the mesocone Marginal teeth are short, wide and tricuspid, the ectocone becoming variously split into two to four denticles on the outer teeth. There are 32 or 33 teeth on a side.

This radula differs from that of *N. tridens*[10] by the broader centrals. It is much like that of *Nenia taczanowskii* (Lub.), type of the subgenus *Andinia*, as figured by Polinski, but the marginal teeth of that species are said to be bicuspid.



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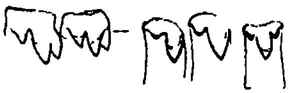

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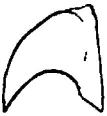

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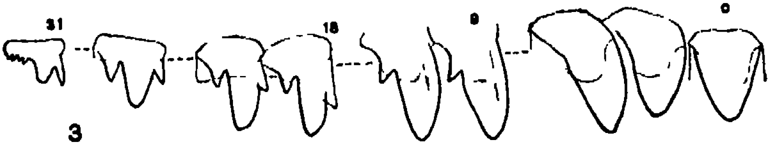

3

Fig. 1. *Temesa incarum*, at the right a lateral tooth from another row.
Fig. 2. *Nenia* (*Columbinia*) *marshalli*, St. Helena, Bolivia.
Fig. 3. *Nenia* (*Steereana*) *steereana*, at 3a a lateral tooth in profile.

The subgenus *Columbinia* Polinski appears to be more numerous in species than any of the others. It includes species with fine, even striation and typically, a rather long, rounded neck. Probably the basally angular forms with similar sculpture belong here also, forming a section *Gonionenia*, with *N. dohrni* (Pfr.) as type. *Nenia* (*Columbinia*) *marshalli* from St. Helena, Bolivia, has tricuspid central teeth and bicuspid laterals. The basal plates are long, the cusps short. The marginal teeth are tricuspid, or the ectocone may be bifid (Text-fig. 2).

As would be expected from conchological characters, the radula of this *Columbinia* shows relationships to that of the subgenus *Incania*, but *N.* (*Incania*) *jelskii* is described and figured by Polinski as having a single cusp on the central teeth, much longer than the mesocone of *Columbinia*.

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[10] W. G. Binney, Ann. N. Y. Acad. Sci. III, pl. 7, f. H. F. Wiegmann in Hesse, Proc. Malac. Soc. Lond. XVI, p. 154.

Nenia cyclostoma, according to Wiegmann (in Hesse) has the same type of teeth

Nenia marshalli n sp Text-fig 4

Type No 361116 U S N M , from St Helena, Bolivia, collected by W M Mann of the Mulford Biological Exploration of the Amazon Basin

The shell is slender, fusiform, widest at the penult whorl, slightly below the middle, moderately solid, snuff-brown, uniform (or paler below the suture), rather glossy Sculpture, after the initial smooth 1½ whorls, of fine, sharp, straight, rather strongly oblique, retractive striæ, narrower than their intervals, on the face of the penult whorl six to eight striæ in one millimeter The apex is entire, obtuse, all of the whorls, down to the last, are rather strongly convex, the last whorl becoming more flattened laterally in its first half, then descending in a rather long neck, nearly round except for a deep groove above the aperture in continuation of the suture The aperture is small, shortly ovate, oblique The peristome is pale brown, well reflected, the upper margin straightened and horizontal The outer margin is retracted a little at its upper end The superior lamella is thin but rather high, internally continuous with the spiral lamella, which is scarcely curved at its junction with the superior lamella The inferior lamella recedes so that it is not visible in a direct front view, but is seen to be moderately strong in an oblique view from below The subcolumellar lamella is immersed, as in other Neniæ The principal plica is short, dorso-lateral The short upper-palatal plica is united with the slightly arcuate lunella Length 16 5 mm , diam 3 5 mm , 8 whorls Type (right hand figure) Length 15 mm , diam 3 5 mm Paratype (left figure)

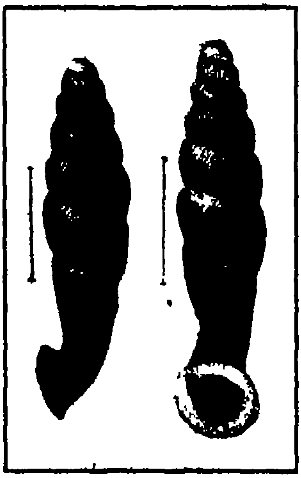

Fig 4 *Nenia marshalli*.

The clausilium is rounded distally

This species has much the figure of *Nenia bryantwalkeri* Pils , but it differs by the finer sculpture, the shape of the aperture, shorter principal plica, the less curved lunella and especially by the shape of the distal end of the clausilium It belongs to the evenly sculptured group of species forming the subgenus *Columbinia* Polinski, and differs from *N columbiana*, the type of that group, by the relatively wider, more fusiform shape and the smaller size *N bolıviana* Sykes is smaller, with a much shorter neck than *N marshalli*

The eight specimens are very similar throughout The type, 361116, figured paratype, 363252, and four others, 363253, are in the U S National Museum, two paratypes, 140175, in the collection of The Academy of Natural Sciences of Philadelphia Named for Mr Wm B Marshall of the U S National Museum, author of several valuable papers on South American naiades, among others The dentition is drawn in Text-fig 2, page 11

TEMESA H & A Ad

Temesa H & A Adams, Genera of Recent Mollusca, II, 1855, p 175 Pilsbry, Manual of Conch (2), X, p 134, *B clausilioides* Reeve designated type *Cf* Sykes, Journ of Malac V, Dec 1896, p 59, Proc Malac Soc London, IV, 1901, p 220

This is apparently a genus of *Clausiliidæ* comparable to *Reinia* in Japan, *Austrobalea* in South Africa and *Balea* in Europe All lack the clausilium and have much reduced apertural armature, and are to be regarded as simplified derivatives of as many diverse clausilid groups Whether *Temesa* is directly related to *Nenia* cannot be positively decided at present, but it seems quite probable The deeply immersed, dorsal position of the subcolumellar lamella is common to both, and the teeth of the radula in *T incarum* are very similar to those of some *[illegible]niæ*

T clausilioides (R[illegible]), *T magnifica* Sykes, and the new form described below are the only species known, the "*Balea*" *funcki* Pfr, from Chacopo, province of Merida, Colombia, being too imperfectly understood at present for definite classification

The group *Exbalea* Jousseaume,[11] having *Balea peruviana* 'Phil' Pfr for type, has been considered a synonym of *Temesa* by Mr E R Sykes

I have examined the teeth of *T incarum*, a species closely related to *T. peruviana;* see Text-fig 1, on page 11 The central tooth is as wide as the laterals, with a stout cusp about as long as the basal plate The inner laterals are similar but asymmetrical, but after the first one or two teeth, minute traces of ectocones appear, becoming well developed on the outer laterals, which have a long, oblique and slightly curved mesocone There are 8 lateral teeth The marginal teeth, at least 16 in number, are tricuspid, and in some of the outer ones the side cusps are bifid

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[11] Bull Soc Philomathique de Paris (2) II, 1900, p 34

This radula does not differ much from that of *Nenia steereana*, the type of the subgenus *Steereana* Jouss

Temesa incarum n sp Plate II, fig 6

The shell is sinistral, rather thin, deeply rimate, slender, with the last whorl widest, the penult almost equal to it in diameter, those above tapering slowly to the small but somewhat obtuse apex The first 2½ whorls are convex, dilute russet colored and nearly smooth The following whorls are flattened, joined by an impressed suture, finely, irregularly striate, the striæ mainly white and nearly concealing the indian-red ground The last four whorls are also rather *strongly, irregularly malleate*, partly in spiral order, base of the last whorl is rounded, finely striate The aperture is brown within, rather acutely ovate, the white peristome narrowly reflected, continuous, being very shortly free above The superior lamella is represented by an extremely low, short callus in the typical position Inferior lamella receding, barely visible in a direct front view, within the back it is rather low and ascends in a spiral The subcolumellar lamella is deeply immersed, dorsal in position, not very strong Length 14 mm , diam above aperture 3 5 mm , length of aperture 4 mm 8 whorls There is no trace of spiral lamella, palatal plicæ or lunella There is no clausilium

Lake Junin, Peru, 13,000 ft Type 140097, ANSP, collected by Mr Russell W Hendee, and presented by Mr Wm H Weeks

This species appears to stand close to *Temesa clausilioides* (Rve) from Cajamarca province, with which Mr Sykes has united *Balea peruviana* Pfr ,[12] from Yanaoca, province of Cuzco According to the figure given by Sykes,[13] Reeve's species has deeper sutures, the whorls being slightly swollen just below them, there is no malleation of the surface, and the shape of the aperture is entirely different The inferior or columellar lamella appears to be stronger than in *T incarum*

EXPLANATION OF PLATES I AND II

PLATE I —Fig 1 *Epiphragmophora huancabambensis*, n sp Type.
2 —*Epiphragmophora oroyensis*, n sp Type.
3 — " *clausomphalos inferior*, n. subsp Type
4 — " *diluta* (Pfr) Above Cuzco, 11,400 ft
5 — " *urubambensis*, n sp Type
6 — " *olssoni*, n. sp Type
7 — " *multesima*, n sp Type

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[12] *Balea peruviana* 'Philippi,' Pfeiffer, Malak Blätter 1867, p 78, *Exbalea peruviana* Jousseaume, Bull Soc Philomath Paris, n s., II, 1900, p 34, pl 1, figs. 13, 14

[13] Proc Malac Soc London, IV, p 221, fig I

PLATE II —Figs 1, 2, 3 *Pleurodonta basidens rugospira*, n subsp Type
4 —*Drymaeus weeksi*, n sp Type
5 —*Synapterpes pennelli*, n sp Type
6 —*Temesa incarum*, n sp Two views of the type
7 —*Strophocheilus kremnoicus vestitus*, n subsp Type
8 —*Bulimulus hendeensis*, n sp Type
9, 10 —*Plekocheilus onca tenebrosa*, n subsp Type

SOME UNUSUAL QUARTZ PSEUDOMORPHS FROM THE HOPEWELL MINE, WARWICK TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

BY GEORGE VAUX, JR

In this paper are described a quartz pseudomorph after datolite, and quasi-crystals which have apparently filled spaces between large crystals of some unknown mineral. These specimens were obtained some time since on visits to the Falls of French Creek in company with Mr Samuel G Gordon, of the Mineralogical Laboratory of this Academy

The Hopewell mine is situated about one mile northwest of Warwick Station, in Warwick Township, Chester County, Penna As long ago as 1858 it was mentioned by Rogers[1] as a locality for fine magnetite crystals It was worked intermittently until 1916, and considerable ore was shipped from it, but it has not been reopened since, the supposition being, with good reason, that the magnetite ore has been practically exhausted

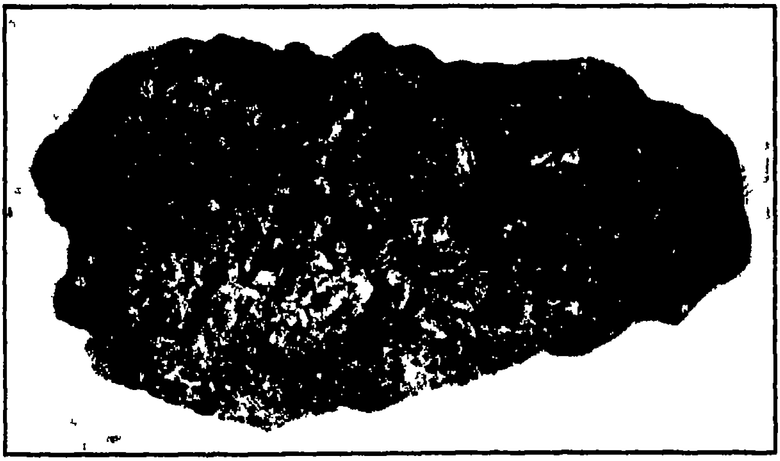

Fig 1 Quartz pseudomorph after datolite, ½ natural size

The ore deposit was similar in type to that of the nearby French Creek mines, at this writing in active operation The country rock is the Pickering gneiss of precambrian age Solutions emanating from intrusive masses of triassic diabase have formed contact deposits of magnetite which replaced lenses of limestone in the gneiss Hornblende, garnet and epidote, developed by metamorphism of the limestone, were reported by Benge and Wherry [1]

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[1] Geology of Pennsylvania, II, 707

Jefferis[2] in a paper on the localities in Chester County mentioned quartz pseudomorphs from the Hopewell mine, but gave no details respecting them Through the courtesy of Dr Douglas Stewart, I was afforded the opportunity of examining Jefferis' specimens, now in the Carnegie Museum of Pittsburgh There was no resemblance, however, to the specimens described in these notes

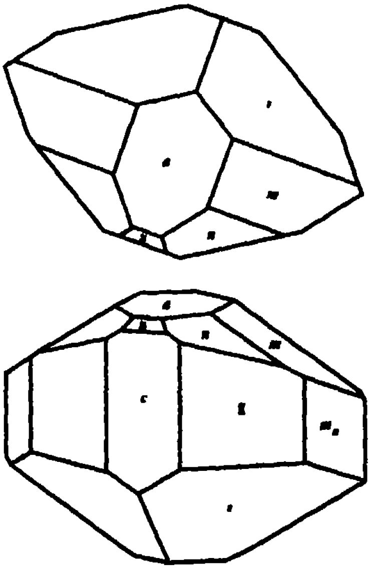

Fig 2 Quartz pseudomorphous after datolite

The specimen about to be described, and a similar smaller one in the collection of the Academy were found by Mr Bentley R Morrison of St Peters, Pa, on the dumps of the mine No data regarding their actual mode of occurrence is therefore at hand From the presence of much limonite on the specimens it is inferred that they were obtained near the surface

The large specimen shown in Text-fig 1, measures about 6 × 9 × 15 inches The upper surface is covered with white, hollow, pseudomorphous crystals up to one and a half inches in diameter Crystallographic measurements kindly made by Mr Samuel G. Gordon showed them to be quartz pseudomorphous after datolite The faces were quite rough, but by silvering a small crystal, good reflections were obtained on the Goldschmidt two-circle goniometer. The following forms, (Text-fig 2) were identified. (Goldschmidt orientation) *a* (001), *c* (100), *m* (011), *x* (101), *g* (110), m_x (120), *n* (122), and *ε* $(\bar{1}11)$

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[1] Mineral Collector, XV, 1908, page 6.

[2] Proc Acad. Nat Sci Phila, 1892, 192.

This specimen bears no resemblance to the solid quartz pseudomorphs after datolite which were described under the name of haytorite by Tripe[4] The Hopewell pseudomorphs are sharp, but mere shells, about 1-50th of an inch in thickness On the interior they sometimes contain thin parallel laminae of quartz, approximately at right angles to the walls

On another visit to the region I obtained eight detached hollow quasi-crystals, also of quartz or chalcedony They are yellowish or grayish-white in color, and measure up to two inches in length The quartz walls are about 1-20th of an inch in thickness, and the interior is somewhat drusy Upon a cursory examination they were thought to be pseudomorphs after some mineral with a sphenoidal habit Measurement on the goniometer, however, after cementing cover glasses to the faces, failed to reveal any planes, axes, or center of symmetry The conclusion has therefore been reached that they were formed as fillings between the faces of groups of large crystals which were later dissolved away A drawing of one of the casts is shown in Text-fig 3

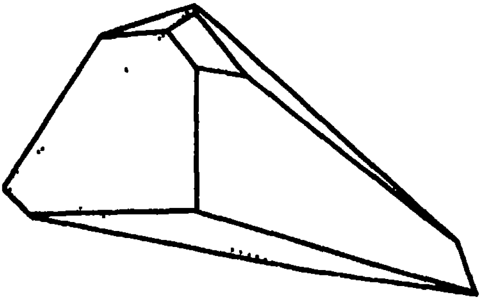

Fig 3 Quartz cavity filling '

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[4] Phil Mag. 1, 40, 1827

SOME ADDITIONAL FAUNAL REMAINS FROM THE TRIAS OF YORK COUNTY, PENNSYLVANIA

BY H E. WANNER.

A paper on the Triassic fauna of York County, Pennsylvania, was published in 1921[1] Since then research work in the same field has been carried on by the author as continuously as time permitted The additional faunal remains discovered are considered to be of sufficient importance to justify their presentation in this report

This work was completed at the University of Pennsylvania under the direction of Dr F Ehrenfeld, for whose instruction and advice I desire to express my appreciation I am indebted to Dr H A Pilsbry for his friendly counsel and assistance, to him also belongs the credit for the identification and description of the Mollusca Dr W D Matthew kindly gave me access to the collection from the Trias of eastern North America in the American Museum of Natural History, New York

The maximum thickness of the continental deposits of the Trias in southeastern Pennsylvania is estimated at 20,000 feet The material contained in them is poorly washed and assorted, this is illustrated by the occurrence of arkose sandstones and conglomerates in the formation

In York County, the Triassic beds, excepting the igneous rocks,[2] consist mainly of red, micaceous sandstones, conglomerates and interbedded layers of shales The sandy layers, with the exception of reptilian tracks, have not as yet yielded fossil remains

Along the borders of the Little Conewago creek in East Manchester township, there outcrops in several places a layer consisting of hard, nodular, calcareous sandstone Calculating from the average dip of the rocks, which is approximately 20 degrees, and the horizontal distance, this layer is 6500 feet above the basal conglomerate, exposed in the railroad cut just north of Emigsville This sandstone is of special interest because in it, or in the shales immediately in contact with it, were found most of the fossils presented in this and in the previous paper

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[1] Wanner, H E Some Faunal Remains from the Trias of York County Pennsylvania Proc Acad Nat Sci Phila, Vol 73, pp 25–37 1921

[2] Ehrenfeld, F A Study of the Igneous Rocks at York Haven and Stony Brook, Pa. and their Accompanying Formations Phila., 1899.

Plant remains are very irregularly disseminated through this sandstone and its associated shale layers Sometimes their accumulation in a thin seam causes the rock to part somewhat easily along the plane of deposition and gives to this area a darker color At one locality rapid transition to the shale above is through a thin, friable layer, black with unrecognizable but undoubted plant remains Plant impressions, not only in this instance but generally, are very fragmentary, mixed, and evidently made by material much decomposed, or badly macerated by water transportation Occasionally small portions of stems and twigs are carbonized

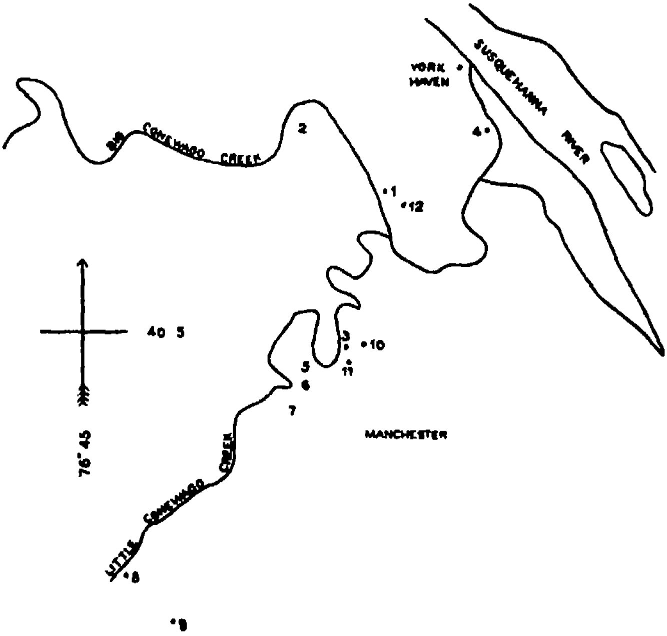

Fig 1 Localities of Triassic exposures

The greater the plant impregnation, the more plentiful are the faunal remains But this statement must not be interpreted to mean that faunal remains are plentiful, the reverse is the case However, every outcrop of this rock was productive after persistent search In it were found bone fragments, teeth, fish scales, some casts of saurian dermal plates, and coprolites. The known outcrops of this rock are plotted on the following map, outlined from the Middletown Quadrangle, Penna (U S Geological Survey).

In order to obtain some data as to the possible origin of this sandstone, a chemical analysis and some thin rock sections of it were made The analyses of two samples follow

Sample	$CaCO_3$	SiO_2	$Ca_3(PO_4)_2$
A	56.2 per cent	31 1 per cent	3 per cent
B	42 3 " "	47 1 " "	2 " "

The rock sections show it to be a nodular sandstone, cemented together by calcium carbonate It contains considerable mica, hematite, and some feldspar and clay The maximum thickness of the layers is two feet There is a rapid transition above and below to shale

The origin of this rock presents an interesting problem It was formed, probably, by the accumulation of material in a shallow lake, swamp, lagoon or estuary The decay of the vegetable matter under water, in some cases, has caused complete carbonization of the thicker stems, resulting in thin coal lenses The quantity of carbonaceous impregnation points to a somewhat luxuriant growth of ferns, rushes and cycads The limestone content, probably, was deposited by evaporation or by chemical precipitation In swamps, plant decomposition may have accelerated this precipitation

Evidence suggesting that this rock was formed under saline rather than fresh-water conditions was found by the writer On one of the shells of *Diplodon yorkensis*, a fresh water mollusk, were found the coiled shells of *Spirorbis inexpectatus* Dr J M Clarke, reporting on this find, stated "You will notice that with the coiled shells are little ostracodes which are also indicative of brackish-water conditions " The presence of these two types of marine fauna attached to the shell of a fresh-water species suggests the conclusion that the continental sediments forming this layer of rock were deposited in a body of water that had some connection with the sea. That this body of water was shallow, is further proven by the imprints on the sandstone of reptilian tracks, rain drops and ripple marks The material may have been deposited in a shallow, brackish, or salt-water lake or a tidal estuary, or mud flat The above conclusion is drawn from the fact that *Spirorbis* and some ostracodes belong to marine and not fresh-water fauna The stratigraphic evidence in this region points rather to fresh than to salt-water deposition

REPTILIAN REMAINS

Part of a jaw, (Plate III, figs 1 and 1a) was found in a black shale along the Little Conewago creek (loc 3) The fossil when uncovered terminated at a break in the posterior end of the jaw, so that the full length of the original cannot be determined At intervals along the bone are depressions, marking sockets from which the teeth have been lost Projecting from the anterior end is part of a tooth, though fragmentary and in poor condition, enough is preserved to identify the specimen as a lower premaxilla of a phytosaur, *Rutiodon carolinensis* (Emmons) [3]

The identification of *Rutiodon carolinensis* from the Trias of Pennsylvania was based on a rib and some isolated teeth found in the Phoenixville tunnel These were described by E D Cope and classified by him under the name of *Belodon lepturus* Subsequently, they were referred by F von Huene[4] to *Rutiodon carolinensis* Measurements —Total length of specimen, 25 5 cm Maximum width, 22 mm Minimum width, 13 mm

In this same black shale were found coprolites, fish scales, impressions of *Estheria ovata* and *Candona rogersi*

The rib of *Rutiodon carolinensis* (Plate III, fig 2) was found in the nodular sandstone (loc 6) A short section is missing, but otherwise it is well preserved Its curvature is pronounced Total length of rib, 30 cm

In the transition layers of shale, associated with the rib, fragmentary plant remains of the following species were identified· *Macrotæniopteris magnifolia, Cheirolepis muensteri* and *Palissya sphenolepis* [5]

Two teeth (Plate III, figs 5 and 6) are similar to those described by W J Sinclair, and are probably teeth of *Rutiodon manhattanensis* [6] The other specimens (Plate III, figs 3 and 4) are probably teeth of *Rutiodon carolinensis* All were found encased in the nodular sandstone (locs 5, 8, 10 and 11)

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[3] J H McGregor Phytosauria Mem of Amer Mus Nat Hist., Vol IX, Part II, p 95, Pl IX, Figs 39 and 39A, 1906

[4] F von Huene Reptilian and Stegocephalian Remains from the Triassic of Pennsylvania in the Cope Collection Bull Amer Mus. Nat Hist, Vol. XLIV, Art XIX, pp 561–574, 1921

[5] A. Wanner Triassic Flora of York County, Penna. Ann. Rep. U S Geol Survey 1898–99, pp 238–253

[6] W J Sinclair A large Parasuchian from the Triassic of Pennsylvania. Amer Jour of Science, Vol XLV 1918.

	Length of tooth	Diameters at base of tooth
Fig 3	15 mm	13 and 8 mm
4	27 5 mm	7 and 5 mm
" 5	48 mm	12 and 10 mm
" 6	31 mm	22 and 15 mm

CRUSTACEANS

Estheria mangaliensis pennsylvanicus new subspecies Text-fig 2

The shape of the carapace valves varies from subovate to subtriangular to suboblong Individuals differ in size The number of ridges of growth varies from 8 to 17, according to age They are more clearly defined and more widely spaced than those of *Estheria ovata* This is indicative of a somewhat thicker and heavier shell The hinge line terminated in front by the umbo is well defined The length of the hinge line, in some specimens, is about one-third that of the valve, in other specimens its length is nearly one-half the length of the valve Length, varies from 5 to 5 5 mm , height, varies from 3 4 to 3 7 mm Diameter, appears to be less than 1 5 mm

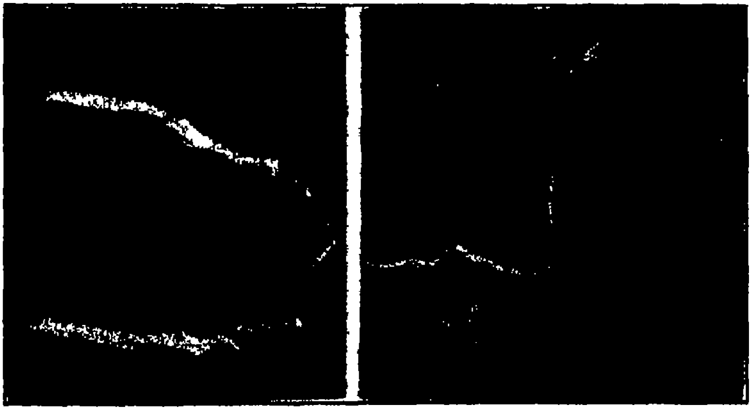

Fig 2 *Estheria mangaliensis pennsylvanicus*

The shells of this *Estheria* are so similar in their character to those of *Estheria mangaliensis*,[8] from the Upper Triassic of Central India, that they are referred to this species However, since this crustacean has never been found in America, the writer feels warranted in assigning it to a separate variety, namely *Estheria mangaliensis pennsylvanicus* The collection of more specimens and further investigation may prove this to be a distinct species

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[7] The transverse diameters are merely approximates as the teeth are partly imbedded

[8] T R. Jones A Monograph of Fossil Estheria Palaeontographical Soc , pp 78-81. Pl II, figs. 16 to 23, 1862

These fossils may be of some value in correlating the age of the Upper Triassic beds of Pennsylvania with those of Central India

The *Estheriæ* were found in scattered masses, some broken and others well preserved, in a thinly bedded, light-green shale along the Big Conewago creek (loc 12) The habitat was fresh water, as they are associated with the shells of fresh water mollusks and plant and reptilian remains

MOLLUSCA

(Contributed by H. A Pilsbry)

Numerous specimens of unionid mussels collected in the past year appear referable, with one exception, to the species described in a former paper One species represented by several specimens seems to be new, but description and illustration are deferred in the hope of finding better material

The following forms are referred to Dawson's genus *Naiadites* with some hesitation Their hinges are not accessible in the material found so far, and a reference based upon external similarity, though not without precedent in palæontologic literature, offends my instincts as a zoologist *Naiadites*, from the Coal Measures of Nova Scotia, is far earlier than the fossils we are dealing with However, the superficial similarity is great, and I have found no genus which appears more appropriate for these fossils

Naiadites triassicus new species Text-fig 3

Locality 3, associated with *Diplodon*, but more abundant, and in better preservation in the layer immediately above, where *Diplodon* becomes rare Type No 12501 ANSP

The shell is subtriangular, strongly convex, with nearly terminal beaks and straight hinge line The posterior-basal extremity is broadly rounded, the basal margin is nearly straight in the middle, and the long posterior-upper slope is slightly convex The surface has numerous fine ripples of growth and some deeper furrows along growth lines, there are also several irregular radial raised lines, perhaps the result of compression

Greatest length 5 mm , width (at right angles to the longest axis) 3 45 mm

Many specimens were found

Naiadites wanneri new species Text-fig 4

Locality 3 With the preceding species Type No. 12502 ANSP

The shell appears to be relatively narrower than *N triassicus*, and differs by the finer, rather even sculpture of fine, close, sharp growth striæ, beautifully decussated by very fine, very close, raised radial striæ Length 3 8 mm

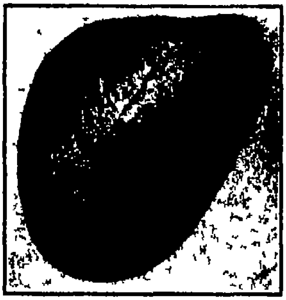

Fig 3 *Naiadites triassicus*

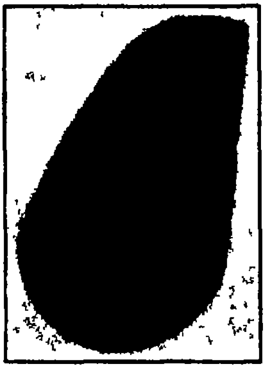

Fig 4 *Naiadites wanneri*

As the dorsal outline of the type is quite imperfect the width cannot be stated This form appears to be rare

SUMMARY OF THE FAUNAL REMAINS FOUND IN THE TRIAS OF YORK COUNTY, PENNSYLVANIA

The numbers in the last column refer to 1, my paper in these PROCEEDINGS for 1921, and 2, the present paper

		Paper
Reptilian tracks	three new types	1
Reptilian remains	rib, jaw and teeth of *Rutiodon carolinensis* (Emmons),	2
	teeth of *Rutiodon manhattanensis* von Huene	2
Crustaceans	*Estheria ovata*	
	Candona rogersi	
	Estheria mangaliensis pennsylvanicus, n var	2
Fish.	Ganoid scales, sp undet	1
Annelids	*Spirorbis inexpectatus*, n sp	1
Mollusks[9]	*Diplodon pennsylvanicus*, n sp	1
	" *borealis*, n sp	1
	" *wanneri*, n sp	1
	" *carolussimpsoni*, n sp	1
	" *yorkensis*, n sp	1

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[9] Found by the author but identified and described by Dr H A Pilsbry

	Paper
Mycetopoda diluculi, n sp	1
Naiadites triassicus, n sp	2
" *wanneri*, n sp	2

EXPLANATION OF PLATE III

Fig 1 —*Rutiodon carolinensis* Lateral (outside) view of right ramus of mandible, somewhat reduced
Fig 1*a*.—The same, viewed from above
Fig 1*b* —The same, cross-section at point marked x
Fig 2 —*Rutiodon carolinensis* Two pieces of a rib, somewhat reduced
Fig 2*a* —Cross-section of same at break
Figs. 3, 4 —*Rutiodon carolinensis* Teeth, natural size
Figs 5, 6 —*Rutiodon manhattanensis* Teeth, natural size

VERONICELLIDAE FROM BRITISH GUIANA

BY H BURRINGTON BAKER

This paper is based on several small lots of Veronicellidae (Gastropoda Pulmonata) collected in British Guiana by Mr Herbert Lang and Mr La Varre, for the American Museum of Natural History The specimens are preserved in alcohol

Vaginulus (Latipes) occidentalis (Guilding) and var **bielenbergii** Semper

Vs occidentalis H B B (1925, Proc Acad Nat Sci Philadelphia, LXXVII, 174, pl V, 18–20), discussion and synonymy of typical form (St Vincent, type locality)

Va bielenbergii Smpr (1885, Reis Arch Phil II–III, 298, pl XXIV–3, 9, pl XXVI–6), form without hyponotal maculations (Puerto Cabello, Venezuola)

Va immaculata Smpr (1885, 300, pl XXVI–11, 13), apparently founded on bleached and immature or much retracted specimens of *bielenbergii* (same type locality)

One practically adult specimen with typical coloration and anatomy (A5922–20) from British Guiana

Two immature animals with typical coloration, (A5922–21) from British Guiana

One large adult, badly bleached so as to be almost uniformly whitish, anatomy typical of *V occidentalis*, (A5922–22) from British Guiana

Two juveniles with coloration of *bielenbergii*, pedal nerves in close juxtaposition to near posterior end of haemocoele, identification uncertain, (A5922–201508) from British Guiana

One animal with typical anatomy of *V occidentalis* but with practically no hyponotal spots, (A5927) from "Bot garden in grass near Benches under the old snail shells which retain the moisture inside," Georgetown

In most groups that are disseminated artificially, one or more species become widely distributed while others retain to some degree their more restricted autochthonous range Thus, *V occidentalis* is apparently the predominant species of *Latipes*, and has invaded most cultivated areas around the Caribbean

Vaginulus (Latipes) cnidicaulis new species. Plate IV, figures 1, 2.

One specimen, the type, (A5927) from Kamakusa Although small, this animal is approaching female maturity and the male organs appear to be quite fully developed

Form. similar to *V occidentalis*, although with notum higher in proportion to width Coloration notum quite dark chocolate-brown with faint indications of blackish spots, hyponotum suffused with dark pigment, wihch is very diffuse towards anterior end but increases in intensity posteriad, sole light cream-colored This coloration approaches that of *Veronicella kraussii* (Férussac, 1823, Hist II 96^x, pl VIII, D, figs 7, 8)

DIMENSIONS

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
V occidentalis (A5922 22)	70	23(16 4)	8(5 5)	52(36 1)	20(5)
V cnidicaulis (type)	35 5	30(10 8)	8(2 7)	55(19 5)	19(5 2)
V pullus (type)	58 0	32(18 3)	9(5 2)	53(31 0)	14(7)

Ovotestis imbedded near posterior end of liver behind stomach Hermaphroditic duct exceptionally long, convoluted Spermoviduct and uterus similar to those of *V occidentalis* and *V olivaceus* (H B B , 1925, pl. V–15), but spermoviduct with a less bulbous enlargement than that in the latter form Albumen gland rather small, pyramidal; apex vertical and imbedded between lobes of liver (instead of below them) Prostate pear-shaped, flattened dorsoventrally Vas deferens (Plate IV, fig 2) first free portion fairly long, canalis junctor almost as stout and relatively short, ramus which enters body wall short and slender Spermatheca sac with long axis almost parallel to that of haemocoele, thick-walled chamber distinctly demarcated, receiving canalis junctor a short distance from its apex, thin-walled (swollen) chamber pear-shaped, stalk almost as long as entire sac and slender, thickened basally The shape of the spermatheca and its stalk must be similar to those in *V fuhrmanni* Srth (1913, Mém Soc Neuchat V, 313, pl XIII, 70–72) from Morron, Colombia, but the accessory bursa of that species appears to be absent in *V cnidicaulis*, or only represented by the basal swelling of the stalk

Anterior free portion of vas deferens (Pl IV, fig 1). slender and slightly convoluted, sheathed for a short distance by retractor of verge which also inserts on it Dart sac papilla subcylindric with a terminal knob, which is definitely demarcated on one side by divergent grooves, tubules (16 counted) fairly long but much convoluted and almost completely enclosed in sheath, retractor quite stout, origin laterad of verge-retractor and just mesiad of slit where vagina enters body wall, expanded anteriad to form sheath for tubules Verge roughly elongate-fusiform with slight basal swelling; middle third with two groups of whitish tubercles; apical third with scattered, fleshy, lanceolate to villiform papillae, the free ends of which are directed posteriad; seminal orifice a transverse, crescentic slit, which is partially covered and rendered subterminal by a slightly protruded anterior lip, and is bounded posteriad by a fleshy fold; retractor quite stout, origin from floor of haemocoele at level of external female opening (i e , some distance behind pericardium). The pedal nerves remain in close juxtaposition to very near the posterior end of the haemocoele

The peculiar armature of the verge must be somewhat similar to that of *V pterocaulis* Srth (1913, 316, pl XIII, 79-86) from Merida, Venezuela, but no marked glans or lateral wings are developed on the verge, the papillate ornamentation seems most like that in some east African Veronicellidae The seminal orifice is shaped much as in *V* (*Angustipes*) *linguaeformis* (see below)

Vaginulus (Latipes) pullus new species Plate IV, figs 3, 4

One specimen, the type, (A5922-20) from British Guiana

This animal apparently has attained full sexual maturity, although the uterus does not contain large eggs

Form similar to that of *V occidentalis* Surface notum and hyponotum uniformly very dark slate-colored, almost black, with fine, but quite conspicuous tubercles which are larger on notum; sole, snout, and lower (bifid) tentacles cream-colored, upper (ocular) tentacles brownish This coloration must be quite like that of *V fuhrmanni* Srth (l c), although the two species differ considerably in the form of the verge and relations of the spermatheca

Hermaphroditic duct, albumen gland, uterus and prostate quite similar to those of *V occidentalis* and *V olivaceus* Spermoviduct similar to that of *V cnidicaulis* Vas deferens (Pl IV, fig 4), first free portion stout and relatively short, canalis junctor long, closely coiled under and behind spermatheca, much stouter than short ramus which enters body wall Spermatheca· fundamentally similar to that of *V occidentalis*, but relatively much smaller, with less swollen thin-walled portion and much shorter stalk

Anterior free portion of vas deferens (Pl IV, fig 3) very stout, terminal loop fastened to walls of penis and its retractor but not sheathed by latter. Dart sac similar to that of *V occidentalis*, papilla relatively much shorter and stouter, with prominent apical nipple; portion of tubules (17 counted) outside of basal sheath comparatively much longer, retractor very attenuate, almost vestigial. Verge· fundamentally similar to that of *V occidentalis*, base with subglobose swelling, stalk at about ¼ length from base with much more prominent spiral ridges, of which the left (as viewed from orificial side) is very strong and forms a practically transverse flange which encircles more than half the circumference, apical portion with two longitudinal rows of angular projections, glans shorter, pyramidal and straight, with several thorn-shaped papillae and a terminal, trifid flap which extends slightly beyond seminal orifice. Verge retractor stout, arises from floor of haemocoele just behind level of posterior edge of pericardium, about half-way between kidney and pedal nerves The pedal nerves remain in close juxtaposition to within ⅛ the length of the haemocoele from the posterior end of the latter

Most species of *Latipes* have some indication of the spiral ridges on the verge, these are very weak in *V occidentalis* but must be rather prominent in *V cordillerae* Srth (1913, 303, pl XII–51) from Argelia Cafetal, Colombia This last species is the first name in a group of poorly differentiated forms (at least *V montanus* and *V alticolus*) which Simroth also described from Colombia, every one of these has a smaller dart papilla, shorter gland tubules, and a larger spermatheca with much longer stalk than has *V pullus*, and probably lacks the peculiar development of the glans which characterises this species *V pullus*, although certainly quite closely related to *V occidentalis*, distinctly approaches the typical group of *Angustipes* in its basally constricted verge and small, short-stalked spermatheca

Vaginulus (Angustipes) linguaeformis Semper Plate IV, figures 5, 6

Va linguaeformis Smpr (1885, 307, pl XXV–4, pl XXVII–3), Guayaquil, Ecuador

Sarasinula linguaeformis Hffm (1925, Jena Zeitschr LXI, 193, 250, pl V, 451, 1), locality of specimen figured not indicated

Two small, but quite mature, much retracted animals, (A5927) from "Bot garden in grass near Benches under the old snail shells which retain moisture inside," Georgetown As these specimens differ in several particulars from both Semper's incomplete original definition and Hoffmann's more recent account, a description of the genitalia may assist future students to determine the correctness of this somewhat doubtful identification

DIMENSIONS

	Animal		Sole	Female Opening Distance from	
	long	wide	wide	ant end	foot
Semper (1885)	90	24(22)	10(9)	52(46 5)	50(2)
Dissertions	24 7	50(12 3)	17(4 3)	57(14 0)	50(2)
Other example	30 0	41(12 2)	15(4 4)	59(17 8)	55(1 8)

Ovotestis, hermaphroditic duct, spermoviduct, albumen gland, uterus (without large eggs), first free portion of vas deferens and canalis junctor: quite similar to those in *V dubius* Smpr (H B B, 1925, 179, pl VI–27), but spermoviduct and vas deferens much shorter Prostate. flattened dorsoventrally, almost circular in outline Spermatheca (Pl IV, fig 6). sac shaped like an obese Lima bean, stalk relatively short

Anterior free portion of vas deferens (Pl IV, fig 5): much convoluted, sheathed for a short distance by retractor of verge, fused inside penial walls with base of verge, which it encircles spirally to enter near lower end of left wing (as viewed from orificial side of verge) Dart sac: much larger than that of verge; papilla elongate conical with small apical nipple, gland tubules (16 counted) short, longest about twice as long as papilla, basally convoluted in a heavy sheath, retractors short, two in number, arising from rami of verge-retractor, inserting by 3 or 4 branches on dorsal and ventral sides of basal sheath In the larger specimen, the dart papilla is extended so as to protrude slightly from the external penial orifice, it appears more elongate and even larger than in the specimen figured Verge similar in general shape to that figured by Hoffmann, but with definite lateral wings which terminate apically in the thin lip that projects beyond the transverse, crenulate-margined, seminal slit, base with spiral expansion which contains seminal duct, retractor remarkably stout, arises as two divergent rami, one from near medioposterior angle of pericardium just in front of spermatheca, other under pedal nerves The median ramus appears to be largely made up of fibers which form the ventral dart-retractor while the lateral one has a small outer division which gives off the dorsal dart-retractor, but the entire complex seems to be connected by interwoven fibers at the junction of the two rami The pedal nerves are in close juxtaposition to within ⅓ the length of the haemocoele from the posterior end of the latter

According to Semper, the (posterior) dart retractors are absent in typical *V linguaeformis*, while, from Hoffman's figure, the verge should lack definite lateral wings and receive the entrance of the vas deferens through its base The spermathecal relations are not described by either author The verge of *V laurentianus* Colosi (1921, Atti Soc It Sc Nat V, 159, 1922, An Mus Nac Hist Nat Buenos Aires, XXXI, 514, fig 52), from San Lorenzo, Argentine, and Caiza, Bolivia, has lateral wings and apparently receives the vas deferens in one of them, but its stalk is much broader and its recurved head relatively much smaller than in my specimens or in Hoffmann's figures of *V linguaeformis* From Colosi's rather unsatisfactory fig 53, the spermathecal sac of his species appears to be distinctly elongate and sessile

EXPLANATION OF PLATE IV

All figures are dorsal views made with aid of camera lucida Scale in lower right hand corner is for entire plate and represents length of one millimeter Transverse lines across vaginae and retractors indicate points of entrance into or of attachment to body wall, those across vas deferens in figs 2 and 4 show edges of prostates. In figures of opened penes, outlines of penial walls are shown diagrammatically by dotted lines, verges are oriented so that seminal orifices are towards left side

Fig 1 —*Vaginulus* (*Latipes*) *cnidicaulis* Opened penis and accessories of type specimen (approaching female maturity) Only terminal loop of vas deferens is shown.

Fig. 2 —*V cnidicaulis* Terminations of posterior genitalia from same specimen, with organs separated and straightened

Fig 3.—*Vaginulus* (*Latipes*) *pullus* Opened penis and accessories of type specimen (quite mature). Only bases of penial walls are indicated.

Fig. 4.—*V pullus* Terminations of posterior genitalia from same specimen, with organs somewhat separated

Fig. 5.—*Vaginulus* (*Angustipes*) *linguaeformis*. Opened penis and accessories of mature animal from Georgetown, British Guiana (A5927)

Fig. 6.—*V. linguaeformis*. Terminations of posterior genitalia from same specimen, with organs slightly separated Only a part of first free portion of vas deferens is shown

ANATOMICAL NOTES ON AMERICAN HELICINIDAE

BY H BURRINGTON BAKER

In a former paper (1922), an attempt has been made to use radular characters as assistance in the systematic grouping of helicinid mollusks (Gastropoda Rhipidoglossa) The present notes are the results of a search for similar clues in the remainder of the anatomy, especially the genitalia Partly on account of the considerable uniformity of helicinid structure, and partly because my scanty material is often immature or in poor condition, this endeavor has only been partially successful However, certain salient features have appeared, so these notes are published in the hope that they may be of use to future workers on the subject

In all cases where lot numbers are given, the animals dissected were from the collection of the Academy of Natural Sciences of Philadelphia, which Dr Henry A Pilsbry very generously assisted me to utilise, and on which the majority of the following descriptions were based However, a number of species were studied from material collected on University of Michigan expeditions to Venezuela (1920), and the Dutch Leeward Islands (1922) In addition, some of the Cuban material was kindly sent me, when I was working on radulae, by Mr John B Henderson The dissections and drawings were made in the Zoological Laboratory of the University of Pennsylvania

HENDERSONIINAE

Hendersonia occulta rubella (Green)

H occulta H B B (1922, 41, pls. III, 1, IV, 10), radula. *H occulta rubella* H B B. (1926), anatomy

During my study on this primitive species, I did not realize what Bourne's (1911, pl XXXV) figures clearly showed that the structure which he called the vaginal sac was ventral with respect to the oviduct, while his caecum was dorsally located. As a result, my homologies (1926, 291) are incorrect in this respect what I called the spermatheca in *Hendersonia* is evidently what he designated the vaginal sac, while my provaginal sac corresponds to his caecum. However, I am still inclined to believe that the provaginal sac (caecum) of *Hendersonia* is probably the structure which is actually homologous with the major portion of the primitive right kidney As will be seen from the following descriptions, the ventral sac is sometimes vestigial in the Helicininae, in which case, the provaginal or dorsal sac may function as the spermatheca The homologies are expressed in the following table

TABLE I PROVAGINAL SACS

Helicinidae (Bourne)	*Hendersonia* (H B B)	Helicinidae in general
caecum	provaginal sac	provaginal sac (dorsal)
vaginal sac	spermatheca	ventral bursa

HELICININAE

The foot, mentum and snout of the Helicininae are fundamentally similar to those of *Hendersonia*, but the sides of the animal are usually firmer and develop a markedly areolate surface The resorption of the partitions between the whorls of the shell seems to have progressed farther, usually the free portion of the retracted animal is only about ½ the length of the last whorl so that the columellar muscles are shorter and the lung invades the visceral mass to a greater extent

The pallial complex of the Helicininae presents several notable differences from that in *Hendersonia* The superficial aspect of the kidney is more narrowly concentric, so that it only extends slightly under the pericardium, on the other hand, it appears deeper and its two lamina usually invest the hindgut to a somewhat greater extent (Pl VI, fig 15) The inner walls of the peripheral (dorsal) lamina are complexly and coarsely folded, although scarcely trabeculate The pericardium is relatively larger The vestigial (right prosobranch) auricle is completely obsolete while the functional (left prosobranch) one is relatively larger and has a conical prolongation which extends some distance along the anterior wall of the pericardium The principal aerating surface of the lung, between the hindgut and left columellar muscle, develops, on the posterior half to two-thirds of its inner surface, a macroscopic network of vessels, which is relatively low and delicate in most of the forms (apparently absent in the minute *Stoastomops*), but becomes very prominent in the subarboreal species of *Helicina*

As in *Hendersonia*, the intestine develops two quite distinct regions (1) a short midgut proper, which retains the ciliated thickening of the stomach, and (2) the long, thin-walled and quite simple hindgut The coils of the midgut proper may be slightly more complex, but any notable increase in the intestinal loops around the posterior end of the oesophagus is mainly due to the added coils of the hindgut (Cf Bourne, 1911, pl XXXII, 10–15) In some species, the midgut is almost equal in diameter to the first portion of the hindgut, but it is always more or less definitely constricted where it passes into the latter The arrangement of these coils varies considerably with the amount of retraction of the animal and I doubt their practical systematic importance The hindgut is usually swollen in young animals In the females, the termination of the hindgut is enclosed by a sort of hood or cloaca, as in *Hendersonia,* this is not developed in the males.

In comparison with *Hendersonia,* the secondary gonaduct appears to have increased in relative length, so that its posterior end in the male, or the apical organs in the female, is almost at a level with the posterior end of the lung On the other hand, the hypobranchial gland has apparently extended anteriad, so that a considerable portion of it lies dorsal to the genitalia, and the opening of its duct is some distance from the apex of the uterus In the Heliciminae, the provaginal duct of the female is only slightly longer than in *Hendersonia,* but, as it opens into the hypobranchial duct in a similar manner, the functional provaginal orifice is some distance anterior to the provaginal and reception chambers The external opening of the secondary gonaduct is usually closer to the thickened mantle collar

The ovary is shaped much as in *Hendersonia* and is similarly composed of smaller alveoli than is the testis The primary oviduct opens out of a thin-walled chamber, but no conspicuous egg sac appears to be developed The slender portion (ovarian tube) of the primary oviduct curves anteriad from the point where it traverses the wall of the visceral cavity and enters at the apex of the right limb of the V-organ The thick-walled, swollen portion is more highly developed than in *Hendersonia,* so that three quite distinct regions may be recognized: (1) the V-organ, (2) its pedicel, and (3) the reception or fertilization chamber The V-organ has very thick walls and usually appears cream-colored in preserved specimens, it consists of an elongate right limb, which is the descending limb of Bourne (1911, 778), an apical swelling and a short, poorly marked left limb The stalk of the accessory sperm sac usually enters near the base of the right side of this left limb and normally is hidden between the two limbs of the V-organ, it is very different from the trilobate enlargement of the apical region which characterizes *Hendersonia* The pedicel of the V-organ is usually narrower than the organ itself, considerably firmer in texture and whitish in color It leads into the reception chamber, which is almost as large in diameter as the apex of the uterus, has comparatively thin, but internally plicate walls, and is usually dark in color This chamber also receives, in close juxtaposition on the right half of its ventral side, the stalk of the ventral bursa, that of the dorsal provaginal sac, and the quite short provaginal duct, a provaginal chamber may be partially separated, as in *Hendersonia*, but no very evident lines of demarcation appear on gross dissection The ventral bursa may be either more complicated than in *Hendersonia* (Cf *Oligyra* s s and *Tristramia*), or much reduced (Cf *Schasicheila* and *Emoda*) The provaginal sac always lies dorsad and to the left of the reception chamber and usually has a fairly long stalk which passes to the right and then curves ventrad to its union with the provagina The uterus is stout and its thick walls usually develop pronounced, transverse constrictions, which are commonly visible through the mantle epithelium and enable one to distinguish the sexes without dissection Throughout most of its length, but the anterior end, which is largely covered by the cloaca, is dark brown or even reddish

In male Helicininae, the provaginal sac appears universally absent, although it possibly may be represented by the apical lobes of the secondary gonaduct The first prostatic chamber is usually much longer than in *Hendersonia* and may form more than half of the secondary gonaduct On its left, it is deeply cleft by a longitudinal furrow, which marks off a ventral from a dorsal chamber, both of these open freely into a common compartment along the right side, which receives the primary sperm duct some distance from its apex The dorsal chamber is complexly sacculate, while the ventral one is usually quite simple, except near its apex where it develops a number of coarse lobes The common chamber is commonly continuous with and similar to the ventral one but may be weakly demarcated by a ventral furrow The second prostatic chamber is also well developed and is commonly lobed weakly along its left side The terminal sac is usually short and thin-walled

The accessory prostate consists of four, rather well-differentiated parts (1) the glandular tube, (2) its basal swelling, (3) the caecum or diverticulum and (4) the common chamber The glandular portion is flattened dorsoventrally between the secondary gonaduct and the mantle epithelium, usually it is dark-colored, very regularly constricted, and longer than in *Hendersonia* The basal swelling is a short chamber which is not marked by distinct constrictions and commonly shows a chalky-white color The diverticulum or caecum is relatively much larger than in *Hendersonia,* but is very thin-walled and inconspicuous, it is undoubtedly the second diverticulum of Bourne (1911, p 786) Both the caecum and the basal swelling of the accessory prostate open into a thin-walled enlargement on the right side of the terminal sac, from which this common chamber is partly separated by a prominent horizontal fold or partition This last is an anterior development of the longitudinal ridge described in *Hendersonia,* in the Helicininae, it may project some distance into the terminal sac but apparently does not form a definite conical papilla

Helicina (Oligyra) orbiculata tropica 'Jan" Pfeiffer Plate V, figures 2, 3, 4

No 84634, from San Antonio, Texas, collected by H A Pilsbry (1903) The one male is slightly larger than the two females

Lung: principal aerating surface, between hindgut and left columellar muscle, develops, on posterior half of its inner surface, a fine network of vessels which give wall a pebbled appearance, anterior half with thicker wall but weaker venation except near muscular collar at anterior mantle edge Oesophageal sacs: voluminous Midgut proper runs from end of stomach anteriad and to right over oesophagus, on right side of latter, turns ventral and abruptly curves posteriad, near side of stomach, becomes slightly constricted and passes into hindgut Hindgut runs anteriad below and slightly to left of oesophagus, forms broad transverse loop to right, turns anteriad and to left above oesophagus, just behind first stretch of midgut; forms a slight anterior loop, and runs along left side of stomach [These convolutions agree quite closely with Bourne's (1911, pl XXXII, 13) representation of those in *Orobophana* (?) *pachystoma ponsonbyi* (although in *Oligyra* the midgut is fully as stout as the first loops of the hindgut), and do not differ materially from those in *Alcadia* (Bourne, 1911, pl XXXII, 10, 11)]

Ovary. golden yellow V-organ (figs 2, 3). cream-colored, with stout right limb, spherical apical swelling and subspherical left enlargement, which receives short stalk of ellipsoid accessory sperm sac near middle of its left side, pedicel ovoid, whitish in color and firm in texture Reception chamber shaped like a pill-box, walls with complex, internal plications Ventral bursa cream-colored flattened dorsoventrally, deeply lobed along its lateral edges, evidently a functional spermatheca and not unlike that of *Hendersonia* Provaginal sac flattened dorsoventrally, subcircular in outline with irregular lobes along its distal side, stalk short and stout Hypobranchial orifice less than ¼ length of uterus from apical end of latter Uterus stout, with pronounced transverse constrictions, apical ⅘ cream-colored, terminal ⅕ dark brown Cloaca, orifice guarded by longitudinal, fleshy lips

First prostate (fig 4) about ½ length of male secondary gonaduct, ventral chamber capacious, weakly lobed at apex, and separated from right chamber by a weak longitudinal furrow Second prostate about ⅔ length of secondary gonaduct, walls thickened and weakly lobed along left side Terminal sac about ⅙ length of secondary gonaduct, truncate-conical, with thin walls Accessory prostate apex near that of 1st prostate, broad with marked transverse constrictions, basal swelling small, chalky-white, apex of broad, but flattened, very thin-walled caecum near apex of second prostate, common chamber thin-walled, horizontal partition broad but thin, with elliptic anterior expansion

Helicina (Oligyra) orbiculata orbiculata (Say) **Plate V, figure 1**

O orbiculata H B B (1922, 42, 44, pls. III, 2, IV, 11), radula.

No 84278, from Miami County, Florida, collected by S N Rhoads

The anatomy is similar to the preceding, but the ventral bursa has much longer lateral lobules (fig 1)

Helicina (Oligyra) convexa Pfeiffer Plate V, figure 5

O convexa H B B (1922, 42, 44), radula.

No 85558, from flats near Frascati Hotel, Bermuda, collected by A Gulick (1902) Male examined is larger than females

Ventral bursa (fig 5) similar to that in *H orbiculata orbiculata*, lobules almost as well developed in immature female (uterus slender, shell without thickened peristome) as in adults

Helicina (Succincta) cacaguelita Pilsbry and Clapp Plate V, figures 6, 7

O cacaguelita H B B (1922, 42, 45), radula.

No 46582, one adult female from Cincinnati, Colombia, collected by J Rehn and M Hebard (Aug 4, 1920) Fresh, and especially immature shells of this species have spiral rows of short, brownish hairs The coloration is very similar to that of *H nemoralis* Guppy.

Lung. similar to that of *Oligyra* s. s, but with even weaker venation.

V-organ (fig 6) right limb relatively elongate, apical swelling large, rounded conical, left enlargement subspherical, receiving short stalk of ellipsoid accessory sperm sac near its base, apical half of pedicel slender, basal half swollen and ovoid Reception chamber much as in *Oligyra* s s Ventral bursa quite small but thick-walled, heart shaped Provaginal sac large, elongate-lanceolate, deeply lobed on distal side, stalk long and quite stout Uterus. similar to that of *Oligyra* s s but with irregular ovoid swellings, anterior end dark brown for short distance (fig 7), cloaca spacious, with less developed lips

The simplified ventral bursa of this species, as well as the shell characters and radula, approach that of *Alcadia* But, the anatomy of *Oligyra* s s is certainly quite distinct from that of *Alcadia* s s, and, in fact, appears closest to that in the subgenus *Tristramia* (Pls V, 8, VI, 9) of *Helicinia* The exact line of demarcation between *Oligyra* and *Alcadia* must await further investigation, but the divergence of the typical groups, already pointed out (1922), seems sufficient reason for their separation, so as to free the better known generic name for the mainly West Indian species (*Analcadia*, *Idesa* and *Alcadia* s s)

Additional study of the radula makes me believe that the "wing" of the outer lateral in *Hendersonia*, *Oligyra* and *Alcadia* is actually some sort of deposit which fastens the two laterals together, rather than an actual cusp, as one might think from my figures (1922, 1923) Whatever this structure may be, it is certainly more obsolete in *Oligyra* s s than in *Alcadia* or even in some species of *Succincta* The peculiar reflection of the comb-lateral of *Lucidella* may be another stage in its disappearance

The ventral bursa is very similarly developed in *Oligyra* s s and *Tristramia*, and, in fact, it is either lobate or noticeably degenerate (possibly immature) in all of the species of *Oligyra* or *Helicina* that I have examined Also, the male genitalia of both groups agree in the shortness of the caecum on the accessory prostate In addition, the shell characters intergrade to such an extent that one meets with considerable practical difficulty in any attempt to differentiate the two groups For these reasons, the inclusion of *Oligyra* as a subgenus of *Helicina* seems advisable, at least until the anatomy of more species can be studied In the present paper, the following subdivisions of the genus *Helicina* are used

Subgenera	Sections
Oligyra .	*Oligyra* s s.
	Succincta.

Subgenera	Sections (*Continued*)
Tristramia	*Tenuis*
	Tristramia s. s.
Oxyrhombus	*Oxyrhombus* s s
	Angulata.
	Tamsiana
Helicina s s	

Helicina (Tristramia) funcki Pfeiffer Plate V, figure 8, plate VI, figure 9

Cf *H zephyrina* H B B (1922, 51, 53, pls. III, 9, IV, 13), for radula.

No 114075, from Gatun, Canal Zone, collected by D E Harrower (1916) The lot includes only one male, which is neither the smallest nor the largest animal in the series All of the specimens are very much retracted

Lung venation of apical ⅔ very prominent, afferent pallial vessel gives off a number of large transverse branches which soon divide and redivide into a coarse network that extends over to pulmonary vena cava

V-organ (fig 8) right limb elongate and quite slender, left limb cylindrical with entrance of short stalk of elongate, complexly furrowed, accessory sperm sac near middle of its right side, pedicel stout, weakly divided by a transverse furrow into subequal halves Reception chamber small, separated from uterus by a very marked constriction Ventral bursa cream-colored, with elongate and subdivided lobes which appear to radiate from its stalk Provaginal sac short, deeply lobed on distal side, stalk very long Hypobranchial orifice at about ⅓ length of uterus from apex of latter Uterus transverse constrictions prominent, left side weakly divided in middle half of its length by a longitudinal furrow, basal ¼ dark brown, remainder cream-colored

First prostate (fig 9): more than ½ length of secondary gonaduct, right compartment continuous with ventral one, which develops complex apical lobes and weak sinistral ones. Second prostate long and slender, left wall thickened and weakly lobed Terminal sac: short, poorly demarcated, with thin walls Accessory prostate apex short of that of secondary gonaduct, basal swelling elongate, caecum with thin walls, extending to near apex of second prostate, slender in apical but swollen fusiform in basal half, horizontal partition very heavy but comparatively narrow

Helicina (Oxyrhombus) concentrica Pfeiffer Plate VI, figures 10, 11

H concentrica H B B. (1922, 48, 53, 1923, 16, pl. IV, 15), radula

Numerous, well-expanded specimens from La Fría, Venezuela, collected by University of Michigan-Williamson Expedition (April 18, 1920) Although considerable intergradation in size is apparent, the females average noticeably larger than do the males The genitalia of all this material appear slightly immature

Lung as in *H funcki*, but with venation network somewhat weaker and forming a narrower zone, carina of shell represented on exterior of mantle, especially on thickened anterior region, where t becomes a heavy ridge which terminates at the mantle edge in an angular projection Oesophageal sacs long Intestine· constriction between midgut and hindgut more apparent than in *Oligyra*, but with similar arrangement of loops

V-organ (fig 10) quite similar to that of *Oligyra*, accessory sperm sac rounded conic, opening near base of left limb, pedicel with a short basal compartment, separated by a pronounced constriction Reception chamber. fairly large Ventral bursa (figs 10, 11): comparatively simple, lateral lobes few and short Provaginal sac broadly lanceolate, posterior half with prominent lobes around edges, stalk short and stout, with a thick-walled lobe between its base and that of ventral bursa Hypobranchial orifice a little more than ½ length of uterus from apex of latter Uterus very noticeable divided along left side into a coarsely-lobed, ventral region, and a finely lobed, dorsal portion which extends between hindgut and mantle epithelium Cloaca very spacious

Male genitalia very similar to those of *H rhynchostoma ernesti* (pl 12), but accessory prostate less distinctly constricted by transverse furrows

Helicina (Angulata) rhynchostoma ernesti von Martens Plate VI, figures 12, 13

H rhynchostoma ernesti H B B (1922, 50, 53, 1923, 17, pl. IV, 18), radula
Cf *H brasiliensis* Bouvier (1887, pl III, 11, 12) for nervous system

Several well-expanded specimens from Palma Sola, Venezuela, collected by University of Michigan-Williamson Expedition (Mar 8, 1920) The males are distinctly larger than the females The genitalia appear slightly more immature than those of *H concentrica*, just described

Lung similar to that of *H funcki*, but with carina similar to *H concentrica* Intestine: like that of *concentrica*

V-organ (fig 12): not unlike that of *H. concentrica*, but with more elongate right limb; accessory sperm sac relatively larger and more ellipsoid in shape, pedicel consisting of narrow apical and thicker basal portions, which are subequal in length Reception chamber· subspherical Ventral bursa elongate claviform, whitish, with very thin walls [The poor development of this ventral bursa may be due in part to the somewhat immature condition of the material, but my experience with *H convexa* makes me doubt if the adult structure would be much more complicated] Provaginal sac: lemon-shaped, not markedly flattened and with heavy walls, stalk fairly long. [This provaginal sac certainly has more the appearance of a functional spermatheca than does the ventral bursa] Hypobranchial orifice. much as in *H concentrica* Uterus slender (immature), with coarse and irregular bosses, basal ⅓ dark brown, swollen

Male genitalia (fig. 13) quite similar to those of *H funcki*, but first prostate is relatively shorter, second prostate elongate with thinner walls, basal sac of accessory prostate subspherical and more noticeably swollen, caecum shorter, horizontal partition stout and fairly broad

Helicina (Tamsiana) tamsiana Pfeiffer Plate VI, figure 14

H tamsiana H B B (1922, 49, 53, 1923, 19, text-fig 20), radula

Several specimens in about the same stage of maturity as those of *H rhynchostoma ernesti*, collected at same time and place The one male is slightly smaller than the largest two females

Lung venation somewhat weaker than in any other species of *Helicina* (exclusive of *Oligyra*) dissected, scar of right columellar muscle considerably more elongate than in preceding species Intestines similar to that of *H concentrica*, but midgut very slender in terminal half and junction with hindgut carried higher into visceral mass Oesophagus and hindgut greatly swollen by food material

V-organ (fig 14) similar to that of *H rhynchostoma ernesti* but subspherical swelling of left limb much smaller, accessory sperm sac very small (immature), subspherical, with relatively long stalk which is swollen basally Reception chamber wider than long Ventral bursa very small, thin-walled, claviform, evidently immature Provaginal sac. somewhat similar to that of *H concentrica* in shape, but with narrower anterior portion and almost no lobes Uterus similar to that of *H rhynchostoma ernesti* but with dark brown, terminal portion relatively longer, cloaca quite like that of *H concentrica*

First prostate not more than ⅔ length of secondary gonaduct, apical and left lobes of ventral region poorly developed (immature) Second prostate, terminal sac and accessory prostate very similar to those of *H neritella* (Pl VI, fig 16), apical portion of caecum longer and stouter but apex slightly anteriad to that of second prostate

Helicina neritella Lamarck Plate VI, figures 15, 16.

Cf H neritella diplocheila H B B (1922, 52, 53, pls. III, 6, IV, 17), for radula.

No 65408, two adult, but much retracted males from Jamaica, collected by J B Henderson (1894)

Pallial complex (fig 15): as in description of subfamily Lung. posterior ⅔ of principal aerating surface with prominent, close network of veins, zone of transverse branches along afferent vessel very narrow

First prostate (fig 16) relatively slender, more than ⅗ length of secondary gonaduct, ventral portion with quite thick walls which are weakly lobed at apex and along left side Second prostate more than ¼ length of secondary gonaduct otherwise similar to that in other species of *Helicina* Accessory prostate long and quite slender, reaching almost to apex of secondary gonaduct, basal swelling small, ovoid, chalky-white, caecum relatively short, apical portion very narrow and thin-walled Terminal chamber swollen, with thin walls

Unfortunately, I have not been able to examine any females of *Helicina* s s , but suspect, from the radula and male genitalia, that their structure will be closest to that in *Tamsiana*

Alcadia (Analcadia) striata (Lamarck) form **subfusca** (Menke) Plate VII figure 17

Cf *O dysoni barbata* H B B (1923, 15, pl III, 12) and *O rufa* (l c , fig 11) for radula

Several well-expanded females from shale and limestone outcrops about two miles out of Cataño, near San Juan, Porto Rico, collected by University of Michigan Expedition (June 8, 1922) All of the shells in this lot have simple, slightly thickened peristomes, but the genitalia appear almost mature I cannot find any characters except the peristome to separate *subfusca* from immature specimens of *A striata* (Cf Wagner, 1907, 93), and adult shells of the latter do sometimes show a heavy growth line that may correspond to a former, thickened lip However, as all of my specimens approach sexual maturity, it seems probable that this apparently paedogenetic form has at least racial significance

V-organ (fig 17) cream-colored, right limb fairly stout, apical swelling subspherical, left swelling also subspherical but considerably smaller, accessory sperm sac almost globular but slightly pointed apically, with short stalk which enters at very base of left swelling, pedicel relatively long, whitish in color, composed of a short, narrow, thick-walled portion and a long-ovoid, thin-walled swelling Reception chamber, relatively very large, weakly lobed on left side Ventral bursa simple, claviform, but fairly thick-walled and solid, mainly cream-colored but with a white nodule at base Provaginal sac relatively small but thick, subcircular in outline with numerous lobules around distal edge, stalk quite short and stout Hypobranchial orifice at a little more than ¼ length of uterus from apex of latter Uterus stout and thick-walled, complexly lobed along left side, ventral surface with an irregular, whitish, longitudinal thickening which is more strikingly demarcated on its left than on its right side, terminal ⅓ dark brown, remainder cream-colored Cloacal opening guarded by heavy, oblique lips

Foot stout and heavy, broad anteriad and roughly triangular

Lung voluminous, posterior ⅔ with very thin wall, venation similar to that in *Oligyra* but considerably weaker, left end of thin (posterior) portion of mantle edge with a rounded flap which projects into columellar notch of shell Right columellar muscle fairly narrow and long with usual oval area of attachment Umbilical protuberance of visceral mass broad but very short and bluntly rounded

Alcadia (Sericea) riparia tachirensis H Burrington Baker Plate VII, figure 18

A riparia tachirensis H B B (1923, 13, pl III, 14), radula

Several fragmentary specimens from La Fría, Venezuela, collected by University of Michigan-Williamson Expedition (April 18, 1920) The genitalia of these animals are not fully mature, although the shells have completed peristomes

Lung. much as in *A striata subfusca,* exterior of mantle with large, black blotches which decrease in density but increase in size towards posterior end of lung

V-organ (fig 18) right limb rather short and stout, slightly swollen apically, left limb short, receiving, near its base, stalk of very small accessory sperm sac, which is imbedded in ventral surface of provaginal sac, pedicel relatively short and subglobose Reception chamber small, with thin walls Ventral bursa much as in *A. striata subfusca* Provaginal sac long-lanceolate, relatively very large, complexly lobed on distal edge, stalk short and very stout Hypobranchial orifice at about ⅓ length of uterus from apex of latter Uterus cream-colored, except for anterior ¼, which is dark brown, walls thick with very irregular bosses but otherwise quite simple (immature) Cloaca relatively small, anterior wall apparently incomplete

Male genitalia (very badly broken in my one specimen): apparently nearest in type to that of *Emoda submarginata* (Pl. VII, 21). First prostate: ventral chamber very large, dorsal pockets coarse but short Terminal sac: short Accessory prostate narrow; apical portion very much dorsal in position, tip curved around apex of secondary gonaduct, caecum long, with apex posteriad of constriction between first and second prostates

Alcadia palliata and hollandi (C B Adams)

A palliata & hollandi Bourne (1911), anatomy *Oligyra palliata* H B B (1922, 42, 47, pl V, 25), radula

Bourne figures both the female (Pl XXXV, 25) and male (Pl XXXVII, 40) genitalia of *A hollandi*, but appears to have generalized the shapes of the various parts, so that it is difficult to compare them with the structure of other species The ventral bursa of the female must be similar to that of *A striata subfusca,* but considerably larger, while the provaginal sac appears very peculiar in shape The details of the V-organ and its stalk are not represented His figure of the male genitalia does not show definitely the divisions of the secondary gonaduct and the caecum seems to have escaped his attention, the last structure actually is very thin-walled and inconspicuous in most Helicininae My own material of *Analcadia* and *Sericea* is not fully mature and only the female of the former is in very good condition As a result, the anatomical definition of *Alcadia* cannot be given at present However, the claviform, thick-walled, ventral bursa and the long accessory prostate and caecum appear to agree most closely with these structures in *Lucidella* and *Emoda*

Lucidella aureola (Férussac) Plate VII, figures 19, 20

L aureola Bourne (1911), anatomy of male; H B B (1922, 53, 55, pls. III, 4, V, 22), radula.

No 104533 two females and one male (the largest specimen), from Jamaica, collected by Amos Brown The animals are so badly macerated that the following account is necessarily vague as to details and may be somewhat inaccurate

Lung: posterior ⅔ of outer wall very thin, venation weak Intestine simplified (Cf. Bourne; 1911, pl XXXII, 14). Right columellar muscle. very wide, area of attachment to shell elongate.

V-organ (fig 19) right limb elongate, apparently constricted near middle of length, apical swelling protruding conspicuously beyond small, ovoid, left limb, which receives, a little dorsal to its left side at its very base, the short stalk of large, long-ovoid, lumpy, accessory sperm sac, pedicel long-ovoid, thick-walled. Reception chamber. large but short Ventral bursa: claviform, quite large and thick-walled Provaginal sac large, dorsoventrally flattened, roughly oval in outline but deeply lobed distally; stalk short and stout Hypobranchial orifice: apparently not ⅓ length of uterus from apex of latter. Uterus. stout, thick-walled, transversely constricted (details cannot be made out from my material); terminal ¼ reddish brown

First prostate (fig. 20): about ⅞ length of male secondary gonaduct, ventral chamber spacious, very weakly lobed apically and on left side, marked off from right chamber by weak furrow; dorsal pockets almost completely hidden between ventral chamber and mantle Second prostate: about $\frac{3}{10}$ length of secondary gonaduct; left wall thickened and very weakly lobed Accessory prostate: long (curved around apex of first prostate) but broad; transverse constrictions numerous and conspicuous, basal swelling small, subspherical, caecum long (extends beyond apex of second prostate), apical portion slender, base swollen fusiform; horizontal partition very weak Terminal sac slender, with very thin walls

Emoda sagraiana (D Orbigny) Plate VII figures 22 23

Helicina sagraiana Bouvier (1887, pls. II, 9, III, 10), nervous system
Schasicheila sagraiana H B B (1922, 53, 56, Cf pls IV, 16, V, 19), radula.
Cf *Helicina titanica* Isenkrahe (1867), first account of Helicinid anatomy

One female from western Cuba, sent me in 1922 by John B Henderson

Foot large and heavy, sole lanceolate, mentum heavy and thick Snout. relatively small, broad but short Principal aerating surface of lung. posterior ¼ thin with very weak venation, next ¼ also thin but with large, transverse, afferent vessels which break up into coarse but irregular network, third ¼ thicker but with quite prominent venation, anterior ¼ still thicker with obscure venation, muscular collar heavy [The venation of this lung is much weaker, in proportion to the size of the animal, than in *Helicina*] Right columellar muscle broad but fairly long, elongate area of attachment some distance from mantle edge Oesophageal sacs very voluminous, oesophagus very slender Radular pouch very long, coiled beyond tips of oesophageal sacs Intestine coils very simple, all above oesophagus, midgut forms very slender loop across oesophagus to right side and back to left, hindgut enormously enlarged, coiled in a complete circle above oesophagus and then imbedded along left side of stomach [This arrangement is quite like that in *Eutrochatella pulchella* Bourne (1911, pl XXXII, 15), but the hindgut does not loop under the stomach]

Apical organs of female genitalia (figs 22, 23) relatively very small V-organ dark amber-colored, right limb rather short, apical portion rounded conical, considerably produced, left limb pear-shaped, receiving, near base of its right side, short stalk of large, rounded-cuboid, lumpy, accessory sperm sac, pedicel whitish, divided into two, subspherical swellings Reception chamber. subspherical, quite small Ventral bursa· apparently reduced to a very small, hard, globular knob Provaginal sac· whitish, large and elongate, coarsely lobed on distal side, stalk funnel-shaped, short and stout Hypobranchial orifice about ¼ length of uterus from apex of latter [Along the dorsal side of the hypobranchial duct is a very complexly lobed body that is creamy yellow in color and gives much the appearance of a functional spermatheca] Uterus: rather slender, cream-colored except dark brown, anterior $\frac{1}{10}$, anterior half of left side very complexly sacculate, posterior half with transverse wrinkles, along right side runs a longitudinal thickening with prominent transverse furrows, just below middle, this is broken by a large, darker-colored, partially separated sac Cloaca relatively small, opening guarded by heavy transverse lips, farther from mantle collar than is usual in Helicininae

Emoda submarginata (Gray) Plate VII, figure 21

Cf *Schasicheila ciliata* H B B (1922, 53, 56) for radula

No 87010, one male from "north-west slope near summit," La Vigia, near Trinidad, Cuba, collected by H A Pilsbry (April 11, 1904)

First prostate (fig 21) almost half length of secondary gonaduct, ventral chamber long and slender, with complex apical lobes but otherwise quite simple; dorsal portion with long and prominent sacs Second prostate. about ⅓ length of secondary gonaduct and broader than first, ventral surface differentiated into a thick-walled, lobed region along left side, which appears continuous with ventral chamber of first prostate, and a much wider, lighter colored, relatively thin-walled but folded area Accessory prostate very long and slender, tip curved around apex of first prostate, glandular portion with very numerous, transverse constrictions, basal swelling small, chalky-white, caecum very long, apical half slender but basal half very broad; horizontal partition with undulate surface, produced considerably anteriad almost like a papilla Terminal sac· relatively slender, about ⅛ length of secondary gonaduct, orifice in close juxtaposition to mantle collar

Schasicheila hidalgoana Dall. Plate VIII, figures 24, 25, 26

S hidalgoana H B B (1922, 53, 57, pl V, 18, 20), radula.

No 98314, one adult male from "mountain sides along canyon," San Luis Potosi, Mexico, collected by A A Hinkley (1909) No 98319, one adult female, from "mountain sides," El Abra, San Luis Potosi, Mexico, collected by A A Hinkley (1909) The male is considerably larger, but more depressed and carinate than the female

Foot: heavy, sole with definite longitudinal groove which divides it into two equal areas; sides with prominent tubercles, which are arranged in oblique rows that run from tip of tail forward and dorsad. Snout weak Lung wall very thin, with a few (12 counted), large cross-veins but no prominent network Right columellar muscle: broad and short; area of insertion about 7 times as long as broad, anterior end very near and in line with prominent notch in mantle edge (similar to sinus in peristome)

V-organ (figs. 24, 25): almost uniform in diameter throughout its length; right limb elongate, apical limb transverse, left limb short; accessory sperm sac of most Helicininae probably represented by a small, apparently sessile protuberance on right side near base of left limb. Pedicel: divided into two subequal swellings, posterior (apical) one gives off from its left side a stout, thick-walled caecum (X) which curves dorsad, expands into three large lobes and must serve as the functional accessory sperm sac. Reception chamber: quite large, with thin walls which develop transverse internal folds that appear as furrows on the ventral surface Ventral bursa. even smaller than in *Emoda sagraiana* Provaginal sac. small, long-ellipsoid; stalk almost as stout as sac and about as long

Hypobranchial orifice. about ¼ length of uterus from apex of latter Uterus posterior ⅔ cream-colored, ventral surface with wide, longitudinal furrow, which separates a right, lobed thickening and a left, simple one, anterior ⅓ chestnut red Cloaca fairly voluminous, mainly thin-walled, orifice guarded by large, heavy, transverse lips, very near mantle collar.

First prostate (fig 26) only about ⅓ length of male secondary gonaduct but very broad, ventral chamber greatly swollen, with weak, transverse thickenings, dorsal sacculate portion with long, tubule-like lobes Second prostate· more than ⅓ length of secondary gonaduct, similar in structure to that of *Emoda submarginata* Terminal sac· relatively slender; orifice with heavy, oblique lips Accessory prostate: glandular portion very broad, tip curved beyond apex of first prostate, transverse constrictions apparently obsolete, basal swelling elongate, caecum (tip torn away with connective tissue during dissection) apparently similar to that of *Emoda submarginata*

The peculiar accessory sperm sac of the female, the broad, short first prostate and the wide simple accessory prostate of the male, and the bipartite foot of both sexes appear to be quite peculiar to this genus Although *Emoda* does appear to be rather closely related to it, in anatomy as well as radula, *Schasicheila* evidently is one of the most aberrant groups in the entire subfamily

Stoastomops walkeri H Burrington Baker Plate VIII, figures 27 to 30

S walkeri H B B (1924, 33, pl. IX, 25), radula.

Animals from Bonaire, Dutch West Indies, collected in August, 1922 As the males examined are larger and more elevated than the females, the type of this species (l c) is probably a large male, instead of a female as suggested in its description

Foot. heavy, wedge-shaped, sole (fig 29) noticeably tripartite, central area firmer in texture than lateral ones Snout: prominent and muscular, tentacles short and triangular [The very firm attachment of these little animals was noted in a former paper (1924); I now suspect that the peculiar structure of the foot enables the snail to establish a vacuum under the central area.]

Visceral mass· external surface mainly jet black, umbilical outgrowth higher than broad, but bluntly rounded. Outer wall of lung: also largely black in males, but lighter in females, very thin, without noticeable venation; mantle collar with a notch and a short angular projection, which correspond in position to columellar tubercle and notch of shell peristome. Right columellar muscle fairly broad but also quite long, area of attachment elongate but distant from mantle edge Oesophageal sacs: slender and quite long Radular pouch long, coiled in a circle high in oesophageal sinus, Loops of intestine. similar to those of *Emoda sagraiana*, but midgut is about equal in diameter to first coils of hindgut and second limb of midgut and left portion of circular course of hindgut are under oesophagus

Apical organs of female (figs 27, 28). relatively large, comparatively stout ovarian tube pierces visceral wall nearer their apex than is usually the case V-organ. right limb large, apical swelling considerably larger than left one, accessory sperm sac ovoid, with relatively long stalk which is swollen at entrance near base of right side of left limb; pedicel long, quite simple Reception chamber fairly spacious with thin walls Ventral bursa: relatively large, slightly flattened dorsoventrally and circular in outline Provaginal sac irregularly triangular in outline, but with a squarish anterior lobe which partially envelops pedicel of V-organ; minutely and complexly lobate so as to appear areolate on surface, stalk stout, forming an elbow which extends considerably to right of reception chamber Hypobranchial orifice about ⅓ length of uterus from apex of latter Uterus stout, transversely wrinkled, anterior ¼ dark brown, anterior tip forming a quite slender papilla inside of cloaca Cloaca spacious, orifice guarded by heavy, longitudinal lips which project anteriad

Primary sperm duct (fig 30). entrance into secondary gonaduct at ⅓ length of first prostate from apex of last First prostate a little less than ⅓ length of secondary gonaduct, ventral chamber with thicker walls than right one but otherwise quite continuous with latter, dorsal chamber with relatively coarse pockets Second prostate with thickened zone along left side and thinner ventral zone (as in *Emoda submarginata*, but not definitely lobed) Accessory prostate. broad but short, apex slightly anterior to entrance of primary sperm duct into first prostate; glandular portion composed of four, subequal blocks and an apical one which is more than twice as large as the others, basal swelling large, chalky-white, caecum elongate, tapered apex posterior to that of second prostate, horizontal partition long and narrow, apparently forming a slight papilla Terminal sac. poorly demarcated, elongate, with thin walls, orifice surrounded by thickened lip

VIANINAE

From the scanty data, the specialization of this subfamily appears to be largely confined to that of the radula, as the anatomy is quite similar to that of *Emoda* Rather notable external features of the Vianinae are the short cephalic region, including the oesophageal sinus, head and foot, the broad and usually short, triangular tentacles (similar to those in *Stoastomops*), and the very prominent, wedge-shaped, umbilical outgrowth of the visceral mass. Also, the accessory sperm sac in *Viana*, at least, is on the left side of the V-organ, instead of on the right as in the Helicininae

Eutrochatella (Troschelviana) jugulata (Poey) *Plate VIII, figure 31*
E jugulata H B B (1922, 58, 59, Cf pl VI, 27), radula.

One male from western Cuba, sent me by John B Henderson

Cephalic region sides very dark in color, sole of foot elliptical, tentacles triangular but longer than in *Viana*, anterior margin of snout markedly emarginate Visceral mass: surface dark in color, umbilical outgrowth prominent but shorter than in *Viana* Lung: wall mostly quite thin, bases of transverse branches of afferent vessel evident, but remainder of venation very weak. Right columellar muscle. broad and quite short, distance between elongate area of attachment and mantle collar is about equal to length of former Oesophageal sacs as long as oesophageal sinus and quite slender Radular pouch less elongate than in *Viana*, tip recurved Intestinal loops. similar to those of *E pulchella* Bourne (1911, XXXII, 15), but first transverse limb of midgut is much lengthened, so as to carry loop far to right, and lower half of circular course of hindgut lies under oesophagus

First prostate (fig 31) less than ⅓ length of secondary gonaduct; ventral chamber quite simple except at apex, demarcated from right chamber by a distinct fold, dorsal chamber complexly sacculate Second prostate similar to that of *Emoda submarginata* but with weaker furrows Accessory prostate. long and quite slender, apex coiled spirally beyond that of first prostate, transverse constrictions of glandular portion distinct and numerous; basal sac ovoid, chalky-white; caecum exceptionally prominent, with fairly thick walls, apex anterior to that of second prostate; common chamber small, subcircular in ventral outline Terminal sac large, with thin walls

Eutrochatella pulchella (Gray)
E pulchella Bourne (1911), anatomy, H B B (1922, 59, 62, pl VI, 31, 32), radula.

From Bourne's figure (1911, pl XXV, 26), the female genitalia appear rather similar to those of *Viana regina* (see below), but the V-organ is less produced apically and the ventral bursa is represented as dorsal in position (this seems rather doubtful) The caecum (p 786) of the male genitalia is described as "well defined" and probably is quite similar to that in *E jugulata*.

Viana regina (Morelet) *Plate VIII, figures 32, 33.*
V regina H B B (1922, 59, 63, pl VII, 34–36), radula.

Specimens from Cuba, sent me by John B Henderson. As the animals were preserved in the shell, their visceral masses were considerably macerated, and I was able to extract entire only one mature female and an immature one However, enough of one male was saved to prove that, contrary to Wagner's suggestion

(1910, 185), the large shells with peculiarly emarginate peristomes are developed in this sex

Foot: heavy: sole relatively small, oval in outline Tentacles short and triangular Visceral mass umbilical outgrowth wedge-shaped, three times as high as broad Kidney more elongate than in *Helicina neritella* (Pl VI, 15), especially attenuate at basal (left) end, dorsal lamina with coarse internal folds, ridge between outer and inner lamina comparatively low, ventral chamber deep, internal surface quite smooth Ureter. with thin walls Pericardium very large Auricle voluminous, with sacculate lobes on posterior side, poorly separated from large pulmonary vena cava, renal veins enter at right end Ventricle smaller, but with thicker, spongy walls Lung voluminous, posterior ⅔ of outer wall extremely thin, venation very weak but similar to that of *Emoda sagraiana* in arrangement Right columellar muscle similar to that of *Eutrochatella jugulata* Oesophageal sacs voluminous Radular pouch very long, looped into a figure S Intestinal coils strikingly similar to those of *Emoda sagraiana,* even to the slender midgut Oesophagus slender, smaller in diameter than large cephalic aorta

Apical organs (figs 32, 33). relatively small V-organ right limb rather short apical region greatly produced; left limb quite slender, accessory sperm sac large, ovoid, complexly convoluted, normally imbedded just dorsal to left side near base of left limb, pedicel divided into two subequal swellings Reception chamber relatively small and short Ventral bursa claviform, considerably enlarged apically into a thick-walled sac Provaginal sac large, dorsoventrally flattened, weakly and coarsely lobed on distal side, stalk short and stout Hypobranchial orifice at about ⅓ length of uterus from apex of latter Uterus elongate, with prominent transverse constrictions, sacculately lobed along left side near base, terminal ¼ dark brown, remainder cream-colored, right ventral surface with a partially separated, longitudinal, sac-like development, which is darker in color than body of uterus Cloaca relatively small, with transverse opening quite near mantle collar Terminal sac of male· large, thin-walled, horizontal partition broad and heavy, anterior end produced into a semicircular flap External opening. transverse, very close to mantle collar, and exactly opposite notch which corresponds to that of shell [The edge of the mantle in this notch is thinner than elsewhere and appears slightly fimbriate, the mantle collar itself is considerably narrowed at this point]

The female genitalia of *Viana* appear to be characterized by the notable elongation of the apex of the V-organ, the sinistral position of the large accessory sperm sac, and the peculiar, longitudinal, uterine pouch, which is better developed than in *Emoda sagraiana*

This uterine pouch somewhat resembles the accessory prostate of male Helicinids, but is not completely separated from the uterus The notch in the shell and mantle collar is a unique feature of the male

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DESCRIPTION OF PLATES V–VIII

All drawings are made with aid of camera lucida from dissections of animals preserved in alcohol Scales represent lengths of one millimeter Unless otherwise stated, all structures are shown as viewed from ventral side, that is, from interior of pallial cavity In practically all drawings of female genitalia, ovary and most of slender portion of primary oviduct are omitted and outlines of hypobranchial duct are represented by dotted lines, in those of male genitalia, testis and most of primary sperm duct are left out In those described as dissections of female genitalia, V-organ is turned back to expose accessory sperm sac, ventral bursa is turned to one side, and provaginal sac is loosened from reception chamber and deflected to right so as to be seen from dorsal (i e, peripheral) side In those from dissections of male genitalia, apical end of accessory prostate is dissected from normal position between first prostate and mantle epithelium. *In descriptions of individual figures, lot numbers are given (in parentheses) for specimens from the Academy of Natural Sciences of Philadelphia*

The following abbreviations are used

B	ventral bursa (female)
C	left columellar muscle (scar)
G	gonad
Bb	accessory sperm sac (female)
Gd	primary sperm duct (female)
Gp	pedicel of V-organ (female)
G2	ovarian tube or slender portion of primary oviduct (female)
G3	right limb of V-organ (female)
G4	reception chamber (female)
Ho	hypobranchial (provaginal) orifice.
Io	intestinal cloaca (female)

L	lung or pallial cavity
Le	anterior mantle collar
P	provaginal sac (female)
S	stomach
T	uterus (female)
Tc	caecum of accessory prostate (male)
Td	accessory prostate (male)
T1	first prostatic chamber (male)
T2	second prostatic chamber (male)
T3	terminal chamber (male)
X	secondary accessory sperm sac (female of *Schasicheila*)

PLATE V.—*Oligyra*, *Succincta* and *Tristramia* Uppermost scale in lower right hand corner of plate is for fig. 8, middle one for figs. 2 and 4, lowest for figs 1, 3, 5, 6 and 7

Fig. 1—*Helicina* (*Oligyra*) *orbiculata orbiculata* Ventral bursa of female (84278) from Miami County, Florida.

Fig. 2—*H orbiculata tropica.* Female genitalia of specimen (84634) from San Antonio, Texas. Apical organs are not separated and lips of cloaca are closed

Fig. 3—*H orbiculata tropica.* Dissection of apical organs from same female.

Fig. 4—*H orbiculata tropica.* Dissection of male genitalia of specimen from same lot (84634). All of hindgut is dissected away, but primary sperm duct and a few basal lobes of testis are shown in outline.

Fig. 5—*Helicina* (*Oligyra*) *convexa.* Ventral bursa of female (85558) from flats near Frascati Hotel, Bermuda.

Fig. 6.—*Helicina* (*Succincta*) *cacaguelita.* Dissection of anterior end of uterus and apical organs of female (46582) from Cincinnati, Colombia. Provaginal stalk stretched so as to appear somewhat too long.

Fig. 7—*H cacaguelita.* Open cloaca and slightly protruding anterior end of uterus from same specimen.

Fig. 8.—*Helicina* (*Tristramia*) *funcki* Dissection of female genitalia of specimen (114075) from Gatun, Canal Zone Animal is considerably retracted, so termination of uterus protrudes from cloaca over mantle collar

PLATE VI—*Tristramia*, *Oxyrhombus*, *Angulata*, *Tamsiana* and *Helicina*. Uppermost scale at bottom of plate is for figs. 11 and 12, next for figs 13, 14 and 15, third for fig. 9, and lowest for fig. 10

Fig. 9—*Helicina* (*Tristramia*) *funcki.* Dissection of male genitalia of specimen (114075) from Gatun, Canal Zone

Fig. 10—*Helicina* (*Oxyrhombus*) *concentrica.* Dissection of female genitalia from slightly immature specimen from La Fría, Venezuela.

Fig. 11—*H concentrica.* Ventral bursa of another, more mature female from same locality.

Fig. 12.—*Helicina* (*Angulata*) *rhynchostoma ernesti.* Dissection of male genitalia of specimen from Palma Sola, Venezuela Ventral sac of first prostate is deflected to right as far as possible, so as to expose sacculate, dorsal portion.

Fig. 13—*H rhynchostoma ernesti.* Dissection of female genitalia of somewhat immature specimen from same locality Hindgut and cloaca are entirely removed; apical organs are twisted so that right side of reception chamber is uppermost; all of primary oviduct and base of ovary is included.

Fig. 14.—*Helicina* (*Tamsiana*) *tamsiana.* Dissection of anterior end of uterus and apical organs of immature specimen from Palma Sola, Venezuela.

Fig. 15—*Helicina neritella.* Dorsal view of apical end of pallial complex of a male (65406) from Jamaica. Mantle epithelium, roof of pericardium and outer wall of lung are removed Heart and pericardium are represented as more transparent than is actually the case, so as to show anterior edge of kidney and course of intestine

Fig. 16.—*H neritella.* Dissection of male genitalia from same specimen.

Plate VII —*Analcadia, Sericea, Lucidella* and *Emoda* Uppermost scale in lower left hand part of plate is for fig. 21, next for fig 23, third for figs 20 and 22, fourth for figs. 17 and 18, lowest for fig 19

Fig 17 —*Alcadia (Analcadia) striata subfusca.* Dissection of female genitalia of almost mature specimen from near Cataño, Porto Rico.

Fig 18 —*Alcadia (Sericea) riparia tachirensis* Dissection of female genitalia of an immature specimen from La Fria Venezuela.

Fig 19 – *Lucidella aureola* Dissection of apical organs of a female (104533) from Jamaica This figure is combined result of sketches made by reflected light, and others made by transmitted light after genitalia had been mounted in glycerin jelly

Fig 20 —*L aureola* Male genitalia of specimen from same lot (104533) This figure is made from a mount in glycerin jelly and accessory prostate is in normal place so that only its lower portion and apex are visible

Fig. 21 —*Emoda submarginata* Dissection of male genitalia of a specimen (87010) from La Vigia, Cuba

Fig 22 —*Emoda sagraiana* Dissection of apical organs of a female from western Cuba.

Fig 23 —*E sagraiana* Female genitalia from same specimen before dissection

Plate VIII —*Schasicheila, Stoastomops, Troschelviana* and *Viana* Uppermost scale in lower left hand corner of plate is for fig. 33, next for fig 31, third for fig. 26, fourth for figs. 24, 25 and 32, fifth for fig 30, and lowest for figs. 27 and 28

Fig 24 —*Schasicheila hidalgoana* Female genitalia of specimen (98319) from El Abra, Mexico

Fig 25 —*S hidalgoana* Dorsal view of apical organs of same specimen

Fig 26 —*S hidalgoana.* Dissection of male genitalia of specimen (98314) from San Luis Potosi, Mexico Tip of caecum accidentally cut away with connective tissue

Fig. 27 —*Stoastomops walkeri* Dorsal view of apical organs of female genitalia of specimen from Bonaire, Dutch Leeward Islands. This figure and next are made from mount in glycerin jelly, so organs are slightly flattened

Fig 28.—*S walkeri* Ventral view of female genitalia from same specimen

Fig 29 —*S walkeri* Ventral view of cephalic region, to show tripartite sole and short, triangular tentacles.

Fig. 30 —*S walkeri* Male genitalia of specimen from same locality Accessory prostate is in normal place so that it is viewed from ventral edge and is partially hidden by caecum

Fig 31 —*Eutrochatella (Troschelviana) jugulata* Dissection of male genitalia of specimen from western Cuba.

Fig 32 —*Viana regina.* Dissection of apical organs of female genitalia of specimen from Cuba.

Fig. 33 —*V regina* Female genitalia of same specimen V-organ is turned so that it and accessory sperm sac are viewed from left side

THE LAND MOLLUSKS OF THE REPUBLIC OF PANAMA AND THE CANAL ZONE

BY H A PILSBRY

I Introduction
II List of species
III Species reported from Panama, not verified by the author
IV Appendix notes on the classification of snails which have been referred to *Microphysa* and *Thysanophora*

I INTRODUCTION

Since the land mollusks of Panama were described and in part illustrated by Eduard von Martens[1] in 1890–1901, the fauna has been increased by numerous additional species, mainly described by S I Da Costa, W H Dall, and myself[2] Material collected by A A Olsson in the course of geologic work further augments our knowledge of the fauna and is described herein, and after the work had been thought completed, I received a parcel of specimens from Mr J Zetek, Director of the Barro Colorado Island Biological Station, together with his annotated MS catalogue of non-marine mollusks By this generous gift several species and numerous localities are added to the list, and various errors in my original draft corrected The occasion has been taken to catalogue all Panamic land mollusks now known

The establishment of the Barro Colorado Island Biological Station in the Canal Zone will doubtless lead many zoologists to investigate that rich tropical fauna Keys to the larger genera and figures of most of the species are given here to facilitate the work of those who take up the mollusks In the absence of such a guide hitherto, a large library and considerable investigation would be required merely to determine the species in any collection of Panamic Mollusca

In the body of the list are admitted only those species I have seen and others of which Panamic examples have been figured or fully described Various other species reported from the Republic of Panama are enumerated in another list (page 104) Evidently at least part of these are species additional to those I have seen, but some of the identifications appear to be inexact, and all require confirmation before admission to the Panamic catalogue

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[1] Biologia Centrali-Americana, Mollusca Panama genera enumerated on pp xiii and xiv 16 genera, 23 species

[2] The papers of these authors are referred to under the several species described.

Seventy-seven species and subspecies of land snails are known at present from the Canal Zone and the Republic of Panama Probably this number will eventually be doubled Forms which may turn up and are not found in this list require comparison with the Colombian and the Costa Rican faunas The writer will be glad to receive and identify species from the Isthmus, especially any not described below, and also fresh-water forms, which will be treated in another paper

The ecologic relations of Panamic mollusks have but rarely been recorded by those who have collected up to this time Very few of these snails are known anatomically[3] Our knowledge is thus quite lopsided, even on the systematic side The locomotion, which can be studied only with living material, deserves investigation

The geographic relations of Panamic land snails and slugs are shown in the following table, in which the northern and southern limits of the genera and species are roughly indicated

To show distribution within the Republic, the following table is divided into several sections based on the provincial boundaries, a rough division, but the only one practicable in the absence of data regarding many of the stations.[4]

It will be seen from this list that 34 species, or 44 per cent of the whole, have been found only in the Republic of Panama and the Canal Zone Twenty-four species, or 32 per cent, also northward Thirteen species, or 16 per cent, both north and south, and 6 species, 8 per cent, only southward Of the 31 genera, 20, or about two-thirds, occur both north and south of the Isthmus, 3, or about one-tenth, southward only, 8, or about one-fourth only northward

These figures have no great significance, since the Costa Rican fauna is the best known in Central America, while that of north-

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[3] For dissection land mollusks should be drowned (by immersion for usually about 10 hours) in order that they may die extended It is best to pass through weak alcohol before final preservation in 70 per cent Never use formaldehyde! Particularly desirable for dissection are all the heliciform snails, *Averellia*, *Thysanophora*, *Microconus*, all Zonitidæ and Scolodontidæ, the Veronicellidæ and all other slugs.

[4] Thus, many species are reported simply from "Chiriqui", whether from near sea level or high on the volcano of that name is not known. In general, the elevations and local conditions are known to me in only a small portion of the species.

Panamic Genera and Species.	Distribution north (west) of Panama	B del T Chiriqui	Veraguas to the C Z	Canal Zone, Panama City Islands	Colon Panama (E of C. Z)	Limit of Distribution south (east) of Panama.
AMPHICYCLOTUS	Mexico					Brazil
A olssoni	—	—	×	—	—	—
POTERIA	Mexico, West Indies					S Brazil, Ecuador
P. gigantea	Costa Rica (?)					Ecuador (a var)
P confusa	—	—	×	×	—	Antioquia
P dysoni	Oaxaca and Yucatan	—	×	—	—	—
P d. affinis	—	×	—	—	—	—
P panamensis	—	×	—	—	—	—
TRUNCATELLA	S-W California, Florida, West Indies					—
T bairdiana	Acapulco ?	—	—	×	—	—
HELICINA	Northern Mexico, West Indies					Brazil
H. isthmica	—	—	—	—	×	—
H oxyrhyncha	?	—	—	—	×	—
H heighwayana	—	—	—	—	×	Colombia
H amoena	Yucatan	×	—	—	—	—
H. funcki	Costa Rica	×	×	×	—	Colombia
H. tenuis	Central Mexico	—	×	—	—	—
(S. g. Oligyra)	Southern U S., West Indies					Northern South America
H beatrix	Costa Rica	×	—	—	—	—
LUCIDELLA	E Mexico, West Indies					Venezuela
L lirata	Eastern Mexico	×	—	×	—	Venezuela
LEPTARIONTA	Vera Cruz					—
L venusta	—	×	—	—	—	—
AVERELLA	Eastern Mexico					Trinidad, Venezuela
A macneili	Costa Rica	×	—	—	—	—
A coactiliata	Tabasco, Yucatan	—	×	—	—	Trinidad
PLEURODONTE (Labyrinthus)	Costa Rica					Guiana, Peru
P sipunculata	—	—	—	—	×	—
P s annulifera						

Panamic Genera and Species.	Distribution north (west) of Panama	B del T Chiriqui	Veraguas to the C Z	Canal Zone, Panama City Islands	Colon Panama (E of C Z)	Limit of Distribution south (east) of Panama
P otis						Colombia
P o. orthorhinus	—	—	×	×	—	—
P uncigera	—	—	—	—	×	Colombia
P chiriquensis	—	×	—	—	—	—
THYSANOPHORA	Arizona					Venezuela
T conspurcatella puella	(conspurcatella in Yucatan)	—	—	×	—	—
T amula	—	—	—	×	—	—
T balboa	—	—	×	×	—	—
T canalis	—	—	—	×	—	A subsp in Venezuela
T caecodes	Nicaragua	×	—	×	—	—
MICROCONUS	Eastern Mexico					—
M termitarum	—	—	—	×	—	—
AURIS[6] (Eudolichotis)						Northern South America
A. distoria panamensis	—	—	—	×	—	*A distoria* in Venezuela
PLEKOCHEILUS						Northern South America
P perriensis	—	—	—	—	×	—
BULIMULUS (*s str*)[7]	Central America, W Indies					Argentina
B unicolor	—	—	—	×	—	—
B corneus	Guatemala	—	—	×	—	—
DRYMAEUS	Mexico, Florida					Argentina
D josephus errans	*josephus* in Costa Rica	×	×	×	—	—
D translucens	—	—	—	×	—	—
D. t. sororcula	—	—	—	×	—	—
D t misellus	—	—	×	—	—	—
D panamensis	—	—	—	×	—	—
D alternans	Guatemala	—	—	×	—	—
D. expansus balboa	—	—	—	—	×	*D expansus* in Peru
D. semimaculatus	Guatemala	×	—	—	×	Colombia
D. inusitatus	Costa Rica	×	—	—	—	—
D hoffmanni	Costa Rica	×	—	—	—	—

Panamic Genera and Species.	Distribution north (west) of Panama.	B del T Chiriqui	Veraguas to the C Z	Canal Zone, Panama City Islands	Colon Panama (E of C Z)	Limit of Distribution south (east) of Panama.
D bugabensis	—	×	—	—	—	—
D chiriquiensis	—	×	—	—	—	—
OXYSTYLA	Mexico, Florida					Brasil
O princeps	Mazatlan	—	×	×	—	—
SUBULINA	Tropics, both hemispheres					Brasil, Ecuador
S octona[8]	Mexico, West Indies	×	×	×	—	Brasil, Ecuador
LEPTINARIA	Mexico, West Indies					Brasil
L panamensis	—	—	×	×	—	—
L lamellata concentrica	lamellata in West Indies, etc	—	×	×	—	Bolivia, Ecuador
L interstriata	Costa Rica	×	—	—	—	—
L. filicostata	Guatemala	—	—	×	—	—
L. costaricana	Costa Rica	—	×	—	—	—
OPEAS	Tropical and subtropical					Both hemispheres
O gracile[8]	West Indies, southern Mexico	—	×	×	—	Para and Guayaquil
O adamsi						
O pumilum[8]	West Indies, Central America	×	—	×	—	Argentina
O micra	West Indies, Central America	×	—	×	—	Bolivia
O beckianum	Eastern Mexico	×	×	×	—	Brasil
EUGLANDINA	Southern U S					S Brasil, N Peru
E dactylus	—	—	×	×	×	Ecuador
E gigantea	Costa Rica	×	—	—	—	—
E cumingi	State of Tabasco	×	×	×	—	Venezuela
E chiriquiensis	—	×	—	—	—	—
E. aurantiaca	Costa Rica	×	—	—	—	—
E broctoniomlini	Costa Rica	×	—	—	—	—
SALASIELLA	Mexico					
S browni	—	—	—	×	—	—
STREPTOSTYLA	Eastern Mexico					
S viridula	Costa Rica	×	—	—	—	—
S chiriquiana	—	×	—	—	—	—

Panamic Genera and Species.	Distribution north (west) of Panama.	B del T Chiriqui	Veraguas to the C Z	Canal Zone, Panama City Islands	Colon Panama (E of C Z)	Limit of Distribution south (east) of Panama
PALLIFERA	Northern U S					——
P costaricensis	Costa Rica	×	—	—	—	——
GUPPYA	U S					Brazil
G gundlachi	Texas, Florida and West Indies					Venezuela
EUCONULUS	All northern continents					
E browni[9]	——	—	—	×	—	——
ZONITOIDES	All northern continents					
Z ostauri[9]	——	×	—	—	—	——
Z. hoffmanni[9]	Costa Rica	×	—	×	—	——
SCOLODONTA						Argentina
S. zeteki	——	—	—	×	—	——
S antoni						
DREPANOSTOMELLA	Costa Rica					Bolivia
D stolli	Costa Rica	×	—	—	—	——
SUCCINEA[10]	Alaska					Sts. of Magellan
S. panamensis	——	—	—	×	—	——
S. luteola	——	—	—	×	—	——
PUPISOMA	Florida, Texas					Brazil
P dioscoricola	Florida, Texas	—	—	×	—	Brazil
GASTROCOPTA[10]	N America; Old World					Argentina
G. servilis	Bermuda, W Indies, Mexico	—	—	×	—	Argentina
VAGINULUS	West Indies, Guatemala					South America
V. occidentalis	West Indies, Guatemala			×		

[5] *Pleurodonte* proper, with various subgenera, is West Indian
[6] Typical group of *Aurus* in southeastern Brazil
[7] Various subgenera of this extensive genus are represented from Missouri to Argentina
[8] Widely spread over the world by commerce
[9] Generic position more or less doubtful until the animals can be dissected
[10] On all continents and most islands.

western Colombia, adjacent to the Isthmus, is almost unknown Moreover, the land snails of the Republic of Panama east of the Canal Zone are far less known than those westward, and many more remain to be found, especially minute species

Of 30 species from Chiriqui and Bocas del Toro, 6 are widely spread both north and south, 16 only northward, and 8 found only in these Provinces, of these 8 the affinities of 7 are with the Central American, and of 1 (*Labyrinthus*) with the South American fauna The fauna is thus overwhelmingly Central American

In the Canal Zone (plus Panama City and the adjacent islands) some 38 species have been found, of which 11 are widely distributed forms, 10 northern, 4 South American, and 13 special to the Zone Of the latter, 6 are about equally related north and south, and of the rest, three are South American and 4 northern in their affinities Thus, excluding the generally spread tropical forms and those of about equally northern and southern affinities, 14 of the Canal Zone forms are distinctively northern in their affinities, and 7 are as clearly South American.

Of the 8 species reported from eastern Panama, 2 occur also in Colombia, and the others are all distinctly Colombian in their affinities

It appears therefore that while the transition between the South American and tropical North American faunas is gradual, some genera of each region penetrating far into the other, the change is most rapid in a comparatively short section of the isthmus at and immediately east of the Canal Zone

II LIST OF SPECIES

Keys to molluscan families based upon the shells alone are necessarily artificial They cannot be expected to work except for the fauna in view in their construction

KEY TO PANAMIC FAMILIES

1	Snails provided with an operculum, eyes sessile; two tentacles	2
	No operculum; eyes stalked, the tentacles below them, shorter, sometimes wanting	4
2	Diameter of shell about equal to or much exceeding the height	3
	Much longer than wide, cylindric with truncate summit, quite small, living near the sea	*Truncatellidæ*, p. 67.

3	Base imperforate, with a small callus over the umbilical region	*Helicinidæ*, p	68
	Base umbilicate, whorls somewhat tubular; of moderate or large size	*Cyclophoridæ*, p	65
4	Slugs, with no shell or an internal vestigeal one		5
	Snails, having an external, well-developed shell		7
5	Foot occupying the whole under surface, genital and anal orifices and pneumostome opening on the anterior part of the right side		6
	Under surface tripartite, genital and other orifices beneath, the upper surface being unbroken	*Veronicellidæ*, p	104
6	Mantle covering the whole upper surface	*Philomycidæ*, p	99
	Mantle a small shield on the anterior part of the back	*Limacidæ*, p	99
7	Diameter of the shell equalling or generally much exceeding its height		8
	Length of shell much greater than diameter		9
8	Shell clear or somewhat transparent, thin, glossy, the aperture with sharp simple lip	*Zonitidæ* and *Scolodontidæ*, p.	99
	Shell more or less opaque, often brown or banded	*Helicidæ*, etc , p	74
9	Aperture obstructed by teeth on the parietal wall, columella and outer lip, shell of short whorls, the form slowly tapering, approaching cylindric, summit blunt		10
	No teeth, or only entering folds on parietal wall or columella or both		11
10	Length 5½ to 7 mm , suture crenulate	*Streptaxidæ*, p	98
	Length about 2 5 mm , suture even	*Pupillidæ*, p	103.
11	Shell ovate, fragile, of about 2½ to 3 rapidly enlarging whorls, aperture large, over two-thirds as long as shell	*Succineidæ*, p	102.
	Whorls more numerous, aperture smaller		12
12	Columella abruptly or obliquely truncate below, or strongly twisted		13
	Columella passing in a curve into the basal margin		14
13	Aperture occupying more than half the total length	*Glandinidæ*, p	93.
	Aperture smaller	*Achatinidæ*, p.	88.
14	Rather capacious shells of moderate to large size.	*Bulimulidæ*, p	81.
	Small, narrow shells, one-colored and pale	*Achatinidæ*, p.	88.

CYCLOPHORIDÆ

Key to Species

1	Operculum thin, chitinous, shell smoothish, large and depressed, openly umbilicate, diam 54 mm	*Amphicyclotus olssoni*
	Operculum rigid, largely calcareous (*Poteria*)	2
2	Large species, diam over 40 mm	3
	Smaller, less than 30 mm diam	4
3	Umbilicus contained 5 to 5⅔ times in diameter, upper angle of aperture usually with a small sinus, channelled	*Poteria confusa.*
	Umbilicus contained 4 to 4½ times in diameter, upper angle of aperture not sinused, not channelled	*P gigantea*
4	Umbilicus small, contained 4 to 6 times in total diameter, striæ wavy	5
	Umbilicus much wider, height 10, diam 15 mm	*P panamensis*
5	Rather high, height 18, diam 25 mm to 14 × 17 mm, caliber of whorls large	*P dysoni*
	Lower, height 15, diam 20 mm, caliber smaller	*P d affinis*

Amphicyclotus olssoni, n sp Plate IX, figs 1, 1a

Near Lagarto, Province of Colon (A A Olsson). Type 47354 ANSP.

The shell is large, solid, depressed with low, conic spire and ample umbilicus, its width a little more than one-fourth that of the shell Nearly white, or cream color where deeply worn, under a rather glossy black periostracum, becoming brown on the spire, the decorticated early whorls coral red Surface lightly, rather, closely marked with lines of growth The whorls are convex, rather slowly increasing at first, the last rapidly increasing, descending in its last fourth below the periphery of the penult, flattened and a little impressed below the suture, evenly rounded at periphery and base, decidedly expanding to the aperture The aperture is very oblique, wider than high, angular posteriorly, the interior light blue, the peristome blunt, rather thick, cream color with a wide border of the same inside, at the posterior angle a slight gutter runs inward Columella narrow, slightly concave, parietal callus rather thick The umbilicus is perspective, rapidly widening at the last whorl

Height 30 mm, diam 54 5 mm, width of umbilicus 14 5 mm 6 whorls

The operculum is flat, dull brownish, of about 12 whorls, the outer four subequal, diminishing slightly to the last, smoothish Interior face with a small central mucro with a low encircling ridge forming a ring of about 5 mm diameter. The dull scar of attachment is broadly oval, eccentric, its edge notched where it passes the mucro

Poteria (Neocyclotus)[11] **gigantea** (Reeve)

Near Panama, in woods (Cuming); Panama (Boucard), Colombia on the Atrato River slope of Sierra Darien at about 1000 ft (A E Heighway)

Definitely localized Panamic specimens have not been reported A Serrania del Darien specimen collected by A E Heighway (98287 ANSP) measures: height 30, diam 51 3, width umbilicus 12 5 mm One stated to be from Costa Rica, collected by Wm M Gabb, has a diameter of 58 5 mm, umbilicus 13 mm[12] Varieties of *P gigantea* have been found at Cauca and Marmato, Colombia, and in Ecuador (*P g fischeri* Hid)

This species differs from the more depressed examples of *P. confusa* (such as Pl IX, fig. 2) chiefly by the larger umbilicus, its width contained from 4 to 4½ times in that of the shell

Poteria confusa (Sykes) **Plate IX, figs. 2, 3.**

Aperostoma confusum Sykes, Journ of Malac VIII, 1901, p 106, pl 10, fig. 2 (Panama)

Gatun, C. Z. (D E Harrower) Quipo (J. P. Chapin), near Lagarto, Prov Colon (Olsson)

The spiral descends more than in *P gigantea*, and the umbilicus is less ample, its width contained from 5 to 5¾ times in that of the shell Typically, there is a little bay or channel at the upper insertion of the lip, as in Pl. IX, fig 3, but this is quite inconstant in several lots seen, many being like fig 2, thus approaching *P gigantea* Two examples from Quipo figured measure·

Fig 2 Height 28 mm, diam 44 mm, width umbilicus 8.5 mm

Fig 3 Height 31 mm, diam. 42 8 mm, width umbilicus 7.5 mm

In some individuals the chestnut and yellow colors of the periostracum are replaced by olive

---

[11] Typical Poteriæ are Jamaican The continental species all belong to the subgenus *Neocyclotus* Crosse & Fischer

[12] This is the only Costa Rican record, and unfortunately Gabb, who was careless in such matters, did not note the exact locality of the single, old and bleached specimen obtained, No 12938 ANSP

Cyclostoma duffianum C B Adams, Proc Boston Soc. N. H. II, 1845, p 11, supposed to be from Jamaica, was given to Adams by Mr Duff, who, it is known, had other shells from Panama. T Bland (MS) thought that *C duffianum* was a specimen of *P gigantea*

P confusa occurs elsewhere at Antioquia, Colombia, the specimens agree closely with the original figure, and have the sinuation of the outer lip at its insertion strongly developed

Poteria dysoni (Pfr)

Tonosi, Los Santos Prov (A A Olsson)

Much smaller than the preceding species, with small umbilicus and more or less anastomosing or irregular striæ

Poteria dysoni affinis (von Martens)

Biologia, p 4, pl 1, fig 1

Bugaba, southwestern Panama (Champion) Not present in our collections

Poteria panamensis (Da Costa)

Proc Malac Soc London VI, p 6, pl 1, figs 6–9.

Chiriqui (Da Costa), Panama (Brit Mus)

Not in our collections

It is more widely umbilicate than the other species The operculum has not been described

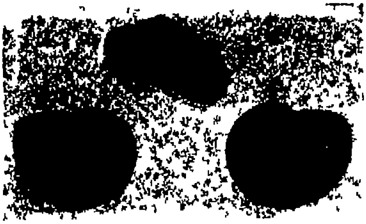

Fig 1 —*Poteria panamensis* (after Da Costa)

TRUNCATELLIDÆ

Truncatella bairdiana C B Ad Text-fig 2

Truncatella bairdiana C B Adams, Ann Lyc N H of N Y , V, July, 1852, p 437, Catalogue of shells collected at Panama, 1852, p 213 Pfeiffer, Monogr Auriculaceorum Viventium, 1856, p 187

Panama, at bottom of the sea wall, under a heap of stones at the high water mark of spring tides (C B Adams) Paitilla, near Panama City and Island of Taboga (J Zetek).

Fig 2 —*Truncatella bairdiana* × 3 A, Taboga I B, Paitilla.

Adams described it as having about 24 ribs on the penult whorl, less prominent on the convexity of the whorls, 5 25 mm long In the series examined there are two forms, one in which the ribs are strong throughout, fig 2 *a*, length 4 2 to 4 7 mm , the other with the ribs more or less effaced in the middle of each of the last 3 whorls, length 4 6 to 5 mm , fig 2 *b* This is Pfeiffer's var β Adams' type appears to have been an intermediate form.

Truncatella (??) *dubiosa* C B Ad is probably an *Assiminea*

The peculiar locomotion of *Truncatella* has been described in Proc A N S Phila , LXVI for 1914, p 426, pl 14

HELICINIDÆ

KEY TO SPECIES

1	Surface with conspicuous sculpture of spiral threads basal lip toothed within, diam. 3 to 4 mm	*Lucidella lirata*
	No conspicuous sculpture, no tooth in the basal lip	2
2	Periphery acutely carinate, upper surface without impressed spiral lines	3
	Periphery strongly angular, several impressed spiral lines on the surface above it, a small projection at junction of columella and basal margin; height 7 5, diam 13 mm	*Helicina amœna*
	Periphery rounded, no spaced spiral grooves above	5
3	Lip having a projecting process at the periphery	4
	Lip angular at periphery, but without a projection, height 8 1, diam 11 8 mm	*Helicina isthmica*
4	Height 9 5, diam 14 5 mm to 10×16 mm	*Helicina oxyrhyncha.*
	Height 13, diam 25 mm	*Helicina heighwayana.*
5	Height exceeding diameter, very smooth; thin, no projection at junction of columella and basal lip	*Helicina beatrix*
	Height and diameter nearly equal, weakly, finely malleate; a salient angle at junction of columella and basal lip	*Helicina tenuis*
	Height decidedly less than the diameter of about 14 mm.	*Helicina funcki*

Helicina isthmica n. sp Text fig 3 b

Rio Puerco, Prov. Panama. Type 140713 ANSP , coll. by A. A Olsson.

The shell is biconic, acutely carinate, the height a trifle exceeding two-thirds of the diameter. Isabella color, the spire a little more yellowish, the keel paler Surface is somewhat glossy, with weak, unevenly developed strongly retractive growth lines and subregularly, rather widely spaced, very low wrinkles; over all a fine, protractive corrugation as in allied species No spiral lines on the upper surface The whorls are rather weakly convex, the last one concave above and below the peripheral keel The oblique aperture is triangular, upper and basal margins somewhat convex Peristome honey yellow, the upper and outer margins rather wide, reflected, angular at the periphery, basal margin paler and narrower, not in the least prominent or toothed where it passes into the columellar callus, which is small, moderately thick, without an axial pit Height 8 1 mm , diam 11 8 mm , 5 whorls

The operculum is orange, fading to yellow at the nucleus

While related to *H oxyrhyncha*, this is a smaller, somewhat differently proportioned species, with the outer extremity of the peristome angular but not rostrate *H concentrica* Pfr differs in sculpture and in having a pit along the columella, which is noticeably unlike in shape

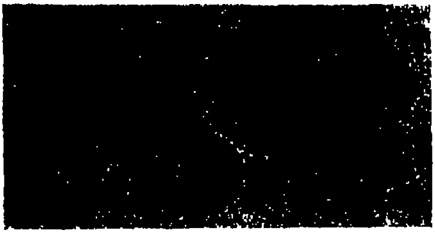

Fig 3 —A, *Helicina beatrix*, Boco del Toro B, *H isthmica*, type C, *H funcki*, Gatun D, E, F, *H oxyrhyncha*, Rio Tucuti All natural size

Helicina oxyrhyncha Crosse & Debeaux Text-figs 3 *d*, *e*, *f*

Journ de Conchyl 1863, p 266, pl 9, fig 4

Lowlands of Rio Tucuti, Prov Panama (A A Olsson).

This species was described as subdiaphanous, pale citron yellow, the carina whitish, diam 14 5, height 9 5 mm This agrees fully with the smaller specimens from Rio Tucuti, Figs 3 *d*, *e* Others are larger and relatively a little lower, with ill-defined rufous bands above and below the periphery, Fig 3 *f* Sculpture of very fine protractive wrinkles over light, irregular retractive growth lines In all, the columella is very short, *without angulation* where it passes into the basal margin, and the pit in the axial callus is very weakly developed Two specimens figured, probably representing both sexes, measure.

Height 9 5 mm , diam 14 5 mm
" 10 " " 16 3 "

Helicina pterophora Sykes,[18] from Guatemala, has been synonymised with *H. oxyrhyncha* by Ancey[14] It is larger, said to measure "Diam 22, alt 8 mm" According to the figure, if the diameter is correctly given, the alt assigned must be wrong, probably it is about 13 mm The shape of the basal lip, as figured, *is not* quite that of *oxyrhyncha*, the peripheral rostrum being situated lower

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[18] Proc Mal Soc Lond V, 1902, p 20

I feel some hesitation about the suggested identity of this species with *Helicina candeana* Sowerby,[15] described as from the Bay of Honduras The baso-columellar curve appears more abrupt than in any specimens of *oxyrhyncha* I have seen, more as in the Venezuelan *H ernsti* v Mts The status of *candeana* and of *H oxyrhyncha* of A J Wagner, and their relationship to *H oxyrhyncha* C & D can be discussed more intelligently when new collections are made in the Bay of Honduras region

Helicina heighwayana Dall

Smiths Misc Coll vol 52, part 3 (No 1866), 1909, p 362, pl 37, figs 7, 8, 9

The locality of this fine species was not given, but as "*Aperostoma gigantea* Gray" was said to be found with it, and an Atrato River species immediately precedes, it was probably from that region, where Mr Heighway collected In shape it is similar to *H oxyrhyncha*, but it is much larger diam 25 mm, height 13 mm, with about 5 whorls

Some immature shells taken by Mr Olsson on the Rio Puerco, Prov Panama, I think are referable to this species. They are evidently distinct from *H oxyrhyncha*

The exact relations of *H. oxyrhyncha*, *H. pterophora* and *H heighwayana* remain to be worked out Possibly there is intergradation, since the differences appear to be largely a matter of size; but proof that this is the case is lacking, and I am disposed to rank them as distinct species.

Helicina amœna Pfr

Von Martens, Biologia, p 28 (*H. amœna* var *b*)

E von Martens records a var *b*, depressed, diam 13, height 7½ mm, from Bugaba, southwestern Chiriqui, collected by Champion

H amœna Pfr has several well-spaced impressed spiral lines above, and an angular periphery. There is a tooth at junction of columellar and basal margins, and a small pit at root of columella Colors are much as in *H funcki*. I have not seen the Panamic specimens

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[14] Nautilus XVIII, 1904, p 22

[15] Thes Conch I, pl 3, figs 97, 99

Helicina funcki Pfr Text-fig 3c.

Escobal, on Gatun Lake (J P Chapin), Mona Creek, Prov Bocas del Toro (A A Olsson); sulphur yellow specimens Gatun, C Z (J E Harrower), sulphur, with a wide jasper-pink zone occupying most of the upper surface of last two whorls Mono Creek (Olsson), spire light coral red, last whorl jasper or flesh pink It has been taken by Zetek on Barro Colorado Island and near Darien, C Z

Helicina tenuis Pfr

Tonosi, Los Santos Prov (A A Olsson)

Thin, with a rather acute spire, a salient angle at the junction of columella and basal lip, light brownish with or without a pale peripheral band Two measure

Height 7 3, diam. 7.7 mm., fully 5 whorls.
" 8 5, " 9 0 " 5½ whorls.

Helicina (Oligyra) beatrix (Angas) Text-fig 3a.

Mono Creek, Prov Bocas del Toro, 5 8 to 7 mm high Another lot, Bocas del Toro, alt 10, diam 9 mm ; both collected by Olsson

Lucidella lirata (Pfr)

Canal Zone Tabernilla, (A P Brown), near Darien and Juan Mina (Zetek) Panama City and Taboga Island (Zetek) Bocas del Toro (Gabb, as *Helicina semistriata*)

This little snail is quite distinct by the strong spiral sculpture and the flat-topped tooth within the basal lip

HELICIDÆ

KEY TO GENERA AND SPECIES OF HELICIDÆ, CAMÆNIDÆ AND SAGDIDÆ

1 Shell solid, opaque, dark or with dark bands, depressed, carinate, the subhorizontal aperture obstructed with teeth and having a continuous, reflected peristome; diam usually over 25 mm *Pleurodonte*, subgenus *Labyrinthus* 2
Shell solid, globose-depressed, periphery rounded, yellow, striate above, aperture not toothed, with thick white peristome, diam 25 mm. *Zachrysia a. havanensis.*
Shell smaller, rather thin, peristome interrupted, the parietal callus thin 6

2	Peristome recurved at the outer and the umbilical extremities, parietal tooth united with the raised parietal margin .	3
	Peristome merely angular at the outer, not curved into umbilicus at inner extremity, parietal tooth standing free of the parietal ridge	5
3	Peristome forming a rounded embayment or loop on the spiral side of the shell, diam. 34 to 40 mm.	4
	Peristome merely notched as seen from the spiral side, diam. 40 to 50 mm.	*Pleurodonte otis orthorhinus*
4	Uniform purplish brown	*P. sipunculata*
	A white band at the keel	*P. sipunculata annulifera*
5	Outer basal tooth is a thin lamina emerging to the peristome near its outer angle, further in is a slender hook, diam. 27 to 34 mm., eastern Panama	*P. uncigera*
	Outer basal tooth with flattened crest, T-shaped, or with a short hook, not running towards the outer angle, diam. between 25 and 30 mm., Chiriqui and B. del Toro	*P. chiriquensis*
6	Diam. about 20, height 12.5 mm., of 3½ whorls, glossy, white with dark bands, narrowly perforate	*Leptarionta venusta*
	Diam. about 10 to 15 mm.; spire level or concave	7
	Diam. less than 6 mm., spire convex or conic, peristome thin, simple .	8
7	Spire concave, two laminae within the subhorizontal aperture, corresponding to external furrows	*Averellia macneilli*
	Spire nearly or quite flat, umbilicus wide, aperture without teeth or laminae, surface dull	*Averellia (Trichodiscina) coactiliata*
8	Minute, with conoid spire and smooth apical whorl; last whorl with growth lines or wrinkles and microscopic spirals	9
	Larger, diam. 3 to 6 mm., apical whorl as well as the last whorl having oblique threads more strongly retractive than lines of growth (sometimes quite imperfectly developed)	10
9	Diam. about 2.6 mm., exceeding the height, umbilicate, of about 4¼ whorls	*Microconus termitarum.*
	Diam. 1.5 to 2 mm., about equal to the height; perforate, of about 3½ to 4 whorls	*Pupisoma dioscoricola*, p. 103
10	Umbilicus open, one-fourth the diameter of shell or wider.	11
	Umbilicus reduced to a mere perforation; spire high; diameter usually less than 3 mm.	*Thysanophora caecoides.*
11	Spire conic; height between 75 and 80 per cent of the diameter of 4.5 mm. more or less	*T. canalis.*
	Spire merely convex, contour lower ..	.12

12 Diam about 3 mm , periphery bluntly angular, situated high on the last whorl, which is somewhat flattened and slopes inward below it, spire very low
T conspurcatella puella

Diam about 4 mm , last whorl less flattened below the periphery, spire more convex, oblique sculpture very well and evenly developed *T amita*

Diam about 4 8 to 5 8 mm , spire convex *T balboa*

Leptarionta venusta Gude Text-fig 4

Proc Malac Soc London, V, 1903, p 263, pl 7, figs 8–11

Chiriqui, Panama

The handsome shell is white, greenish-yellow around the umbilicus, variously banded with dark brown or black Diam 19 to 22 5 mm , of 3½ whorls Not yet contained in American collections

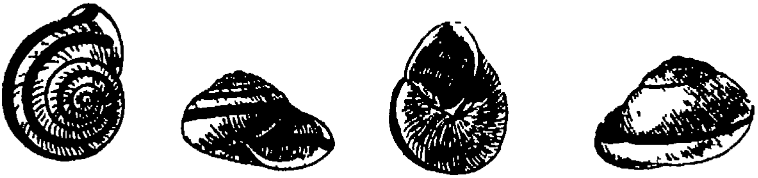

Fig 4 —*Leptarionta venusta* (after Gude)

Averellia macneili (Crosse) Text-fig 5a

Chiriqui Lagoon (MacNeil), Drift of San San Creek, Prov Bocas del Toro (A A Olsson)

Known by the sunken spire, the deeply descending last whorl and the two furrows behind the lip, corresponding to laminæ within Diam 13 to 14 5 mm

Fig 5 —A, *Averellia macneili*, San San Creek B, *A* (*Trichodiscina*) *coactiliata*, Tonosi Natural size

Averellia (Trichodiscina) coactiliata (Fér) Text-fig 5b

Tonosi, Prov. Los Santos (A A Olsson).

Discoidal, broadly umbilicate, the spire nearly flat, and the aperture without teeth or laminæ

CAMÆNIDÆ

Pleurodonte (Labyrinthus) sipunculata (Forbes) Pl 9, fig 4

Helix labyrinthus var *sipunculata* Forbes Proc Zool Soc London, 1850, p 53, pl 9, f 4 *a*, 4*b*
Pleurodonte (*Labyrinthus*) *goldmani* Dall, Smiths Misc Coll vol 59, No. 18, 1912, p 1, pl 2, f 1, 2 (Pirri Range, east of the Canal Zone).

Panama: Paya, and Rio Tucuti, Province of Panama (A A. Olsson)

The color of "dead" shells is walnut brown, fading in places to pecan brown, there is no trace of banding "Live" shells would be darker

Height 14 mm , diam 34 5 mm , 5 whorls. Paya. Pl IX, fig 4
" 15 " " 34 " Rio Tucuti
Diam 34 mm (Forbes' figure)

The chief differential character of *P sipunculata* is that the outer angle of the peristome is so far recurved as to form a conspicuous rounded sinus on the upper face of the shell This structure is developed further than in typical *P otis* Sol , which I figured in these PROCEEDINGS for 1910, pl 37, figs 5, 6, 7 Having now seen a good many Panamic *Labyrinthi*, I am satisfied that *P sipunculata* is specifically distinct.

Pleurodonte goldmani Dall was based upon specimens larger than typical *sipunculata*, height 15 5 mm , diam 39 mm ; otherwise the description and figures agree Its locality, the Cerro Pirre, is near the other localities given above, near the eastern boundary of the Republic

Pleurodonte sipunculata annulifera (Pfr)

Helix annulifera Pfr , Proc Zool Soc London, 1851, p 260 (Dec 7, 1853); Monographia III, p 255 Reeve, Conch Icon , *Helix*, pl 100, fig. 555 (May, 1852)

Panama, Cuming coll

The shell appears to differ from *P. sipunculata* only by having a wide white band at the acute keel. Size, 13 × 34 mm I have not seen this form, which will probably be found in the eastern part of Panama Province

Pleurodonte (Labyrinthus) otis (Sol)

Pilsbry, Proc A N S Phila. 1910, p. 504, pl 37, figs 5, 6, 7
Helix labyrinthus Chemnitz, and of Deshayes, Mag de Zool VIII, 1838, p 1, pl 111, fig 1 Not of Lamarck.

Colombia: near Cartagena (Lloyd B Smith)

In a basal view of typical *P. otis* the parietal and basal margins of the peristome are seen to run parallel near the umbilicus, and at the peripheral extremity there is a notch In *P o orthorhinus* the margins *converge* towards the umbilicus, and the outer extremity is but slightly or not at all notched. Compare figures 4 and 7 on plate 37, of my paper of 1910, where these forms were discussed

Whether *P otis* proper occurs in the Republic of Panama remains doubtful The "Panama" records for it are old and have not been confirmed by recent collectors Mr Lloyd B. Smith gave me a series which he collected near Cartagena, Colombia Probably all the reports of *P otis* (under the name *labyrinthus*) from Panama were based upon specimens of *P o orthorhinus*, but the typical form may perhaps extend from Colombia into the eastern part of the Republic

Pleurodonte otis orthorhinus Pils

Pleurodonte (*Labyrinthus*) *otis orthorhinus* Pilsbry, Proc A. N S Phila, 1910, pp 502, 505, pl 37, figs 1, 2, 3, 4

Pleurodonte labyrinthus Dall, Smiths. Misc Coll, vol 59, No 18, 1912, p 1, pl 2, figs 3, 4 Not of Deshayes.

Near Tabernilla (Amos P Brown), near Gatun dam (A A Olsson), and at Gorgona, collector unrecorded, C Z, Chagres (R Tate), a burned pasture near Darien and Alhajuela, C Z. (J Zetek), Quipo (J P Chapin), Santa Isabel (collector not recorded), Upper Chagres (Zetek)

While this race stands close to *P otis*, yet the large numbers which I have seen from several places show considerable constancy in its special features, mentioned in the key It is the common *Labyrinthus* of the Canal Zone, and so far as we know, the only species found there

Specimens taken by Olsson run up to 48 mm diameter.

Pleurodonte (Labyrinthus) uncigera (Petit) **Text-fig 6c Plate IX, fig 6**

Pilsbry, Proc A. N S Phila, 1910, p 506, fig 1

Pleurodonte tenaculum Dall, Smiths Misc Coll, vol 52, part 3, p 361, pl 37, figs 5, 6, 10, 11

Isthmus of Panama (type loc, Pavagean); Rio Puerco, Prov Panama (A A Olsson) Also over the border in Colombia near the Atrato River, Sierra Darien (Heighway, type of *P tenaculum*)

This species appears to vary considerably in dimensions, but not much in structure or coloration.

Height 9, diam. 27 mm, 6 whorls (Petit, type of *uncigera*)
" 6,[15] diam 30 mm; umbilicus 5 mm.; 5 whorls (*tenaculum*, according to Dall)

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[15] The height assigned to *P tenaculum* must be an error

Fig 6 —Apertural views of A, *Pleurodonte* (Labyrinthus) *chiriquensis* mut *tau* Island of Bocas del Toro B, typical *P chiriquensis*, Chiriqui Lagoon C, *P uncigera*, Rio Puerco Natural Size

Height 13, diam 34 mm , umbilicus 6 mm , slightly over 5 whorls (Rio Puerco)

Height 12 7, diam 33 4 mm , umbilicus 6 mm , (Rio Puerco)

Whether the variation in size has racial significance cannot be decided without further collections, but in the absence of other distinctions, such races would appear weakly characterized

Pleurodonte (Labyrinthus) chiriquensis (Pilsbry) Text-fig 6 a, b Plate IX, fig 5

Proc A N S Phila , 1910, p 506, fig 2

Chiriqui (McNeil) Mono Creek, Prov Bocas del Toro, and island of Bocas del Toro, on fallen trees (A A Olsson)

Comparison with specimens of *P uncigera* show this to be a strongly distinct species They inhabit opposite ends of the Republic Usually the hook in the basal lip is not developed as such, but as a lamina with thickened edge, as in text-fig 6 *a* This form may be distinguished as mutation *tau.*

Zachrysia auricoma havanensis (Pils) Text-fig 7

Fig. 7 —*Zachrysia a havanensis*, Panama City

Cathedral Plaza, Panama City (J Zetek, Nov 21, 1917)

Solid, imperforate, depressed-globose, naples yellow, striate above (these qualities suggesting the specific name), basal lip thickened within by an outwardly truncate white plate. Diam of Panama City specimen, 25.2 mm., barely 4 whorls The type measures, height 18, diam 25 mm

Introduced from Cuba Reported from Panama City as *Pleurodonte provisoria* Pfr [16] in Zetek's 1918 catalogue

SAGDIDÆ

Thysanophora conspurcatella puella n subsp Text-fig 8 b

Taboga Island, type locality (J Zetek), Panama (Don Patricio M Paz)

The shell is constantly smaller than *T conspurcatella*[17], aperture less oblique and not so wide

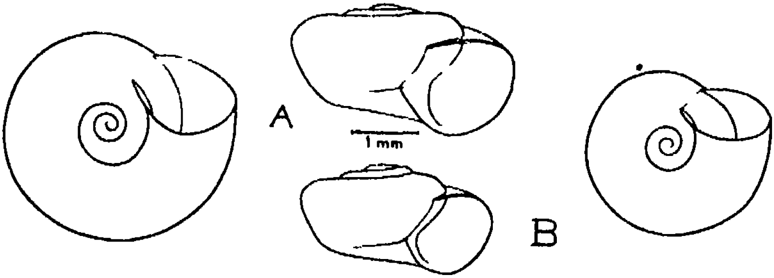

Fig 8 —A, *Thysanophora conspurcatella*, Merida, Yucatan B, *T c puella*, type

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[16] *Helix provisoria* Pfr of New Providence and eastern Cuba differs by the continuous, not truncate, inner margin of the basal lip In the Panamic specimens the truncation is distinct, though less strongly developed than usual in Havana specimens of *havanensis*

This Cuban subspecies was figured as *Helix auricoma* var *zeta* Pfr in Man Conch, V, 1889, p 63, pl 3, figs 24, 25, but my form was not that which Pfeiffer had designated by the letter ζ, (Monographia IV, p 217) which was stated to be *H noscibilis* Fér, referring to the "Histoire" of that author, pl 46A, fig 8 This figure looks more like *H emarginata* Gundl than anything else known to me, being higher than *havanensis*, without the truncate lip-callus. As my "var *zeta*" was thus composite, and erroneous in the reference of the figures given to Pfeiffer's variety, the name may be considered a synonym of *noscibilis*, and the form common about Havana may be called *Z a havanensis*, as in Man Conch, IX, pp 96, 97, pl 22, figs 19–23, type 77459 ANSP

Helix noscibilis was introduced into nomenclature by Beck, Index Moll, p 35, for Férussac's Pl 46 A, fig 8, and if recognised should stand as *noscibilis* Beck

The group of yellow Cuban helices which I called *Zachrysia* (type *H auricoma* Fér) has been associated with *Thelidomus* Swainson, comprising various species of the windward Antilles, but the Cuban forms are not closely related to that series *Thelidomus* has an appendix on the penis and a granulate embryonic shell In *Zachrysia* there is no appendix and a smooth or radially costulate embryonic whorl. It appears likely that *Zachrysia* is to be grouped with *Dendrocochlis* (*H aspera* Fér) and *Eurycratera* (*H jamaicensis* Gmel) *Thelidomus* proper belongs to the series of *Polydontes*, *Luquillia* and *Parthena* (at least the species *dominicensis* and *undulata*, the type of *Parthena*, *H acutangula* Burrow, may perhaps be different)

Helix discolor Fér, of Martinique, may be transferred to *Caprinus* or its vicinity for the time. It certainly is no *Thelidomus*, but in shell characters stands between *Caprinus* and *Isomeria*.

[17] See appendix, p. 120 For comparison a topotype of *T conspurcatella* from Merida, Yucatan, is drawn in fig 8 *a*

Height 1 8, diam 3, umbilicus 0 75 mm 3½ whorls Type.
" 1 8, " 3, " 0 8 " 3½ "

The constantly small size in 18 specimens seen appears sufficient reason for the recognition of this form Specimens received from Paz many years ago were in the collection without name This species was referred to as *Amphidoxa costellata* d'Orbigny in Zetek's Los Moluscos de la Rep Panama, 1918, p 17

Thysanophora amita n sp Text-fig 9, 10

Juan Mina, C Z (J Zetek) Type 45259 ANSP

Similar to *T conspurcatella*, but larger, having the spire decidedly higher and the last whorl much less compressed below the periphery The retractive threads are very regularly developed, more delicate and a little closer Threads of the first whorl are widely spaced

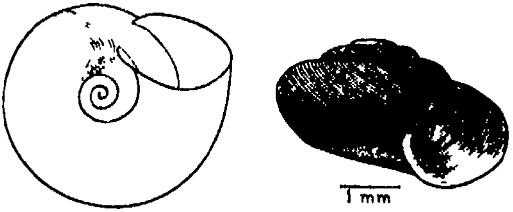

Fig 9 —*Thysanophora amita*

Fig 10 —Detail of sculpture × 15, from photograph

Height 2 3, diam 4 0, umbilicus 1 0 mm 3½ whorls Type
" 2 1, " 3 5, " 0 9 " 3½ " Immature

Thysanophora balboa n sp Text-fig 11

Thysanophora conspurcatella (Morel) with the alleged synonym *Helix panamensis* Perez, Pilsbry, Proc A N S. Phila , 1910, p 502 (no description) Not of Morelet

C Z Las Cascades, type loc (A P Brown), and Juan Mina (J Zetek) Panama (from Morelet coll), Tonosi, Los Santos Prov (A A Olsson)

A species closely similar to *T impura* (Pfr), but differing by the larger size, the whorls of larger caliber at all comparable stages of growth The umbilicus is contained about 3½ times in the diameter of shell The spire is moderately raised, but far less than in *T canalis* The whorls are strongly convex, the last having the periphery above the middle. Sculpture of very low growth-wrinkles

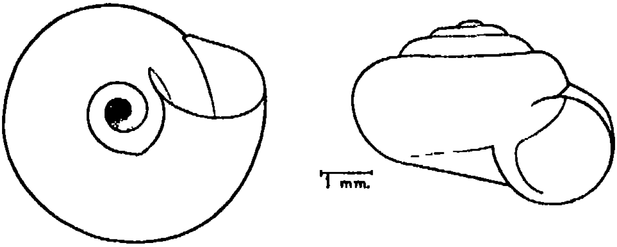

Fig. 11.—*Thysanophora balboa*, type.

crossed by oblique, strongly retractive threads, about 0.06 or 0.07 mm. apart on the face of the last whorl. The color is dull gray-brown. When cleaned it is somewhat glossy.

Height 4 mm., diam. 5.8 mm., umbilicus 1.75 mm. 4⅔ whorls. Type.

Height 3 mm., diam. 4.8 mm., umbilicus 1.4 mm. 4⅓ whorls.

Much like *T. amita* except for the larger size, young shells of the diameter of adult *amita* have the whorls conspicuously more robust.

Thysanophora canalis Pils.

Proc. A. N. S. Phila., LXII, 1910, p. 507, fig. 3. H. B. Baker, Occ. Pap. Mus. Zool. Univ. Mich., No. 167, 1926, p. 13 (Cariaco, Venezuela).

Los Cascades, C. Z. (A. P. Brown).

Relatively large, with the spire higher than in any of the related forms. The retractive threads are only locally well developed, chiefly on the upper part of the last whorl, elsewhere blurred or broken. In an immature, fresh shell they are more extensively present, irregularly interrupted and bearing ragged cuticular appendages. The growth lines are rather inconspicuous. The sculpture of the embryonic whorl is very weak.

Height 3.6,[18] diam. 4.6, umbilicus 1.1 mm. 4¾ whorls.

Thysanophora canalis cariacoensis, new subsp., is the form from Cariaco, Venezuela, collected by F. R. Cocking, mentioned below the original account of *T. canalis*. It is smaller, with the sculpture of retractive threads well developed. Height 3.05, diam. 3.85, umbilicus 0.9 mm., 4½ whorls.

Thysanophora cæcoides (Tate)

Pilsbry, Nautilus XXXIII, 1920, p. 95, text fig. 4.

Panama City (J. Zetek), Bocas del Toro (Ralph Tate).

This species is easily known by the high contour of the shell and its minute umbilical perforation. The retractive threads are well developed. Its synonymy has been discussed in my paper of

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[18] Not 3.8, as stated in the original description.

1920 A very large and high specimen from Panama City measures height 2 95, diam 3 mm It is usually somewhat smaller and relatively lower. height 2 3, diam 2 5 mm , 4¼ whorls (specimen from Nicaragua, R Tate)

Microconus termitarum n sp Text-fig 12a

Canal Zone Barro Colorado Island, collected by Mr J Zetek and I Molino, in the termitarium of *Leucotermes tenuis* Hagen, in soft, dry wood on the ground Type 140824 ANSP

The shell is umbilicate (umbilicus contained nearly 5 times in the diameter), the spire somewhat high, of 4¼ whorls, the apex obtuse The first 1½ whorls are whitish buff and appear to be smooth, without sculpture; after which the surface is chestnut-brown, dull, very minutely, indistinctly roughened by unequal, close, microscopic wrinkles, cut by weakly incised spiral lines Whorls are strongly convex, the last rounded evenly, slowly descending a little in front. The aperture is broadly oval, somewhat excised by the preceding whorl Peristome thin, not expanded except at the columellar margin, which overhangs the umbilicus somewhat

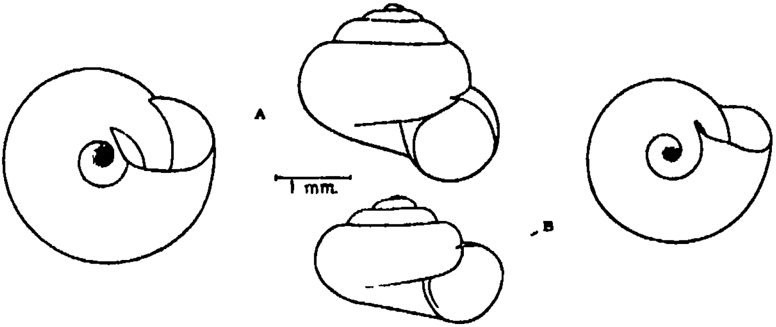

Fig 12 —A, *Microconus termitarum*, type B, *M wilhelmi* Pfr , Mirador.

Height 2 1, diam 2 6 mm , width of umbilicus 0 5 mm

This little snail resembles *Microconus wilhelmi* (Pfr) of the Vera Cruz region, but the whorls are greater in caliber, the individual whorls and the whole shell higher, and the umbilicus is decidedly smaller. Under the microscope the last whorl is more roughly, irregularly sculptured than *M wilhelmi*, which has the spiral lines better developed and the granulation more even and distinct. Strebel and Pfeffer did not use high enough power to see the spiral striation of *M wilhelmi* which, decussating the fine growth striæ, gives the surface a "seidenglänzend" sheen mentioned by them.

A rather small example of *M wilhelmi* from Mirador, the type locality, is drawn in fig 12 *b* for comparison with *M termitarum.* It measures height 2 4, diam 3 2 mm , 4½ whorls Umbilicus contained about 3½ times in the diameter

Microconus Strebel and Pfeffer, based upon the single species *Helix wilhelmi* Pfr , is one of several East Mexican groups of small helicoids which cannot yet be classified definitely The shell has some resemblance to the Palæarctic genus *Pyramidula* (*P rupestris*), belonging to or near the Pupillidæ It might, again, prove to be an endodontid snail, or it may belong in or near *Thysanophora* Until something is known of the anatomy, I do not see that there is sufficient evidence for forming an opinion, and none is intended by the place here given it

The shell is patuloid, rather elevated, with smooth initial whorl and microscopically decussate later whorls, which have uniform pigmentation darker than usual in *Thysanophora*

BULIMULIDÆ

KEY TO GENERA

1	Large shells, over 40 mm long	2
	Smaller, thin shells, with ovate aperture and thin, simple or expanded lip	4
2	Shell solid and strong, with thick or reflected lip	3
	Shell with thin, unexpanded lip, ovate, smooth, with zigzag color pattern	*Oxystyla*
3	Oblong, fusiform, with narrow aperture, reflected lip and strong columellar fold, about 42 mm long	*Auris*
	Broadly ovate with large, ovate aperture and no columellar fold, length 79 to 85 mm	*Plekocheilus*
4	Embryonic whorls indistinctly wrinkled, color dull brownish	*Bulimulus*
	Embryonic whorls with fine, very regular lattice sculpture	*Drymæus*

Auris distorta panamensis Pils

Proc A N S Phila., 1910, p 507, pl 37, fig 8, 9

Between Tabernilla and San Pablo, C Z (Amos P Brown) Barro Colorado Island (Zetek)

Plekocheilus pirriensis Dall

Smiths. Misc Coll , vol 59, No 18, 1912, p 2, pl 1, figs 1, 2

Pirri mountain range (E A Goldman)

A very fine, broadly ovate shell with large aperture Height 79 to 85 mm , diam 54 to 67 mm. The Cerro Pirre stands south of the head of the Rio Tucuti, in the eastern part of Panama Province

Bulimulus unicolor (Sowb)

Perico Island, Bay of Panama (Cuming) Taboga Island (James Zetek)

More slender than *B corneus*, otherwise very similar, and doubtfully distinct

Bulimulus corneus (Sowb) Text-fig 13

Panama City and Old Panama, R P , Balboa and Ancon (J Zetek), Los Cascades, (Amos P Brown), Gatun (D E Harrower)

A plain, light brown species, usually 14 to 17 mm long, the diameter half the length, more or less Recorded as *B constrictus* Pfr in Zetek, 1918

Fig 13 —*Bulimulus corneus*, Ancon, nat size

Drymaeus expansus balboa n subsp Plate X, figs 5, 6, 7

Rio Puerco, Prov Panama Type No 140691 ANSP , collected by A A Olsson

The shell is umbilicate, ovate-conic, thin but moderately strong, with straightly conic spire of moderately convex whorls, the last one well rounded, flattened at the base, bluntly but strongly angular around the ample umbilical cavity Suture evenly impressed, decidedly rising to the aperture, in the later whorls bordered by a very narrow brown line. Sculpture of 1½ embryonic whorls as in typical *Drymaeus*, several whorls following are lightly marked with growth lines, penult whorl is weakly striate, the last whorl strongly so, the striae arching backward a little, covered also with minute and rather weakly incised spiral lines The aperture is vertical, marked within like the outside The peristome expands broadly, trumpet like, the outer margin being regularly curved, the columellar margin straight (or sometimes curved inward), vaulted over the umbilical cavity, columella straight (or sometimes convex). Color, nearly white, faintly brown tinted towards the base, marked with zigzag, brown streaks, which are variegated by the white striae, on the spire the streaks become short. The umbilicus is gray-brown within, with a brown band just within the light basal ridge. The apex is white The expanded lip is white, very faintly violaceous at its inner curvature; the columella faintly violaceous (or dull purplish-brown)

Length 36.7 mm , diam 21 8 mm , length of aperture 21 mm. 6½ whorls.

While this shell is very similar to the Peruvian *D expansus*, it does not agree in detail with any of the specimens of a rather numerous series compared

Drymaeus translucens (Brod) Text-fig 14*a*

King's and Saboga Islands, Bay of Panama (Cuming)

"So translucent that the internal pillar and structure of the shell may be plainly viewed through its glassy surface " Pale yellow Length ⅞ inch 5 whorls

The figure is from a photograph of the original illustration

Drymaeus translucens sororcula n subsp Text-fig 14*c*

Taboga Island (J Zetek) Type 45238 ANSP.

Similar to *D translucens* in transparence, excessively thin and fragile The clear surface shows some white streaks, and it is faintly brown-tinted near the apex There are some very faint and indistinct traces of impressed spiral lines Length 13 5 mm , diam. 6 5 mm , 6 whorls Near *D t subfloccosus* Pils

Drymaeus translucens misellus n subsp Text-fig 14*b*

Tonosi, Prov Los Santos (A A Olsson) Type and 5 paratypes 140281 ANSP

Translucent, very fragile, with the last whorl shorter than in the preceding forms, subangular at periphery, especially in immature stages, marked with white streaks, irregularly more or less interrupted, especially on the penult whorl Having microscopic spiral lines, close, though weak on the spire, scarcely developed on last whorl Length 11 mm , diam 6 1 mm , aperture 6 mm , 6 whorls

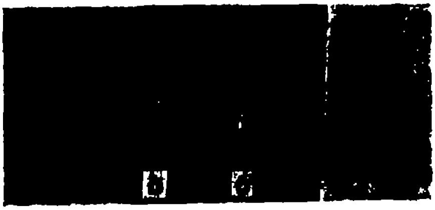

FIG 14—A, *Drymaeus translucens* Brod (after Sowerby, being yellow, this figure photographed abnormally dark) B, *D t misellus* C, *D t sororcula.* D, *D panamensis*, after Sowerby Figs B and C enlarged.

Drymaeus panamensis (Brod) Text-fig 14 *d*

Kings and Saboga Islands, Bay of Panama, on the trunks of large trees (Cuming)

Shell ovate-fusiform, rather glossy, diaphanous, pale tawny; 6 somewhat swollen whorls; lip slightly subreflected. Length 1, diam ½ inch

The figure 14 *d*, from Sowerby's Conchological Illustrations, is said to represent a Saboga Island specimen I have not seen this species

Drymaeus alternans (Beck) Text-fig. 15 *d*, *e*.

Bay of Panama Kings and Saboga Islands

Thin, white, with walnut-brown bands, five on the last whorl, three on the penult Glossy, with lightly engraved spiral lines Usually 16 to 20 mm long, but the size appears to be quite variable, the type about 22 × 12 mm

A form of this species taken by Olsson at Tonosi, Los Santos Province, is smaller and more slender than typical *D alternans*, the aperture is smaller and the bands are narrower Apex black Length 15 5 mm , diam 8 mm , aperture 8 6 mm., 5½ whorls

Bulimus tricingulatus Anton[19] is an unfigured form said to be more elongate than *D alternans*, with the last whorl more obese and shorter, light yellow with *three* dark brown bands Length 1$\frac{1}{12}$ inch , diam ½ inch "Saboja Ins "

Drymaeus josephus errans, n subsp. Text-fig 15 *a*

Mono Creek, Prov Bocas del Toro, type loc , Senori Creek in the same Province (Olsson), between Tabernilla & San Pablo, C Z (Amos P Brown)

Similar to *D josephus* by the short whorls, short aperture and brown streaks on a white ground, but it differs by having the columellar lip pressed in at its insertion, the umbilical area behind it much smaller than in *D josephus* of Costa Rica

Length 28 5 mm , diam 12 7 mm , aperture 12 7 mm.

This is the form mentioned as near *D josephus* in my paper of 1910, p 503, only imperfect specimens were taken by Professor Brown

Drymaeus semimaculatus Pils

Garachino, Prov Panama (A. A Olsson), mut *perversus* Chiriqui Mt (Angas, P Z. S 1879, p 497, as *B maculatus* Lea)

The white shell has five brown bands on the last whorl, the upper three interrupted into square spots, the fourth wider, continuous, and the fifth around the umbilicus The glossy surface is closely engraved spirally

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[19] See Man Conch , XII, p 88, for the original description

The single specimen taken is sinistral This form may be called mut. *perversus*, text-fig 15 *c*

Drymaeus inusitatus Fulton Text-fig 15 *b*

Near Chiriqui Lagoon, on ceiba trees (W F Webb, 1911)

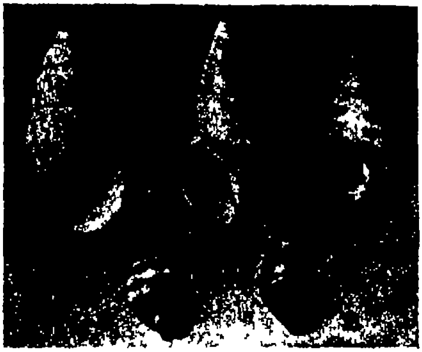

Fig. 15 —A, *Drymaeus josephus errans* B, *D inusitatus*, Chiriqui Lagoon C, *D semimaculatus* mut *perversus* D, *D alternans*, "Panama" E, *D alternans*, Tonosi

Sinistral, very pale yellow, closely engraved with spiral lines Length 27 mm, diam 12 mm, aperture 12 5 mm, 7 whorls

Drymaeus hoffmanni (v Martens) Text-fig 16

Otostomus tripictus var *hoffmanni* v Martens, Biol Contr Amer, Moll, p 225, pl 14, fig. 11, 11*a* (September, 1893)

Drymaeus prestoni Da Costa, Prov Malac Soc London, VII 1906, p 9, pl 1, fig 9 Var *cancellata*, fig. 10

Chiriqui (Da Costa) Type of *hoffmanni* from central and southwestern Costa Rica

Fig. 16 —*Drymaeus hoffmanni*, Chiriqui Natural size.

The banded form, figs 16 *b*, *b'* is the typical color pattern of *hoffmanni*, the streaked form, *a*, *a'*, of *prestoni* Da Costa's var *cancellata* was a connecting form, having both bands and streaks All have the lip pink-bordered

Drymaeus bugabensis (v Mart) Text-fig 17 *a*

Otostomus bugabensis v Martens, Biologia Centr Amer , Moll , p 218, pl 13, figs 21, 21*a*, 1893

Bugaba, Prov Chiriqui, at 1000 ft (Champion)

Subimperforate, long and rather thin, yellow, marked with rather wide and mostly short black streaks Peristome slightly expanded, the columellar margin somewhat thickened and distinctly twisted Length 27 mm , diam 11 mm , aperture 14 mm

I have not seen this species

Drymaeus chiriquiensis Da Costa Text-fig 17 *b*

Drymaeus chiriquiensis Da Costa, Proc Malac Soc London IV, p 238, pl 24, fig 1 Man Conch XIV, p 162

Boquete, Chiriqui

Whitish, painted with three purplish-brown zones with longitudinal streaks of the same color between them, lip reflexed, pale salmon colored Length 29 mm , diam. 14 mm , aperture 17 mm

I have not seen it

Drymaeus is an important genus throughout the humid mainland tropics, and is represented more or less abundantly except in savanna or arid districts, where *Bulimulus* appears to replace it As in most large and varied genera, numerous subdivisions have been named In the Manual of Conchology I found it more convenient to group the species geographically than to attempt a rigid classification, but certain characters of the teeth were indicated which will probably prove significant for systematics when the radulæ of more species are known However, some notes on the subgeneric affinities of the Panamic species may be in place here.

Fig. 17 —A, *Drymæus bugabensis*, after v. Martens. B, *D chiriquiensis*, after Da Costa. Natural size.

D expansus balboa has the well-expanded lip of the typical section of *Drymæus*,[1] and seems very closely related to Peruvian forms. It is the only distinctively South American *Drymæus* of the Panamic list. *D bugabensis*, *D chiriquiensis* and *D hoffmanni* appear to stand with the Mexican "*Goniognathmus*" species. *D josephus errans* belongs to a little group of Costa Rica and Panama in which the lip is well expanded, but the whorls and aperture shorter than in "*Goniognathmus*." I call it Section *Metadrymæus*, type *D josephus* (Angas). It includes also *D zhorquinensis* (Angas), but no other species now known.

All other Panamic species have the lip simple. They appear to belong to the section *Mesembrinus* Albers.[20] *Antidrymæus* Germain[21] has the shell characters of *Mesembrinus* except that the shells are sinistral, but I doubt whether this section or subgenus can be upheld, as the several sinistral species known do not seem to be directly related to one another, but rather to various diverse dextral stocks. *Mesembrinus* is well represented in South America, Mexico, the West Indies and Florida. The distinction between *Mesembrinus* and *Drymæus* of the *Goniognathmus* type seems at times rather forced. As von Martens remarked, the species "are linked to one another by gradual affinities."

Oxystyla princeps (Brod). Text-fig. 18.

Between Tabernilla and San Pablo, C. Z. (Amos P. Brown); Barro Colorado Island (J. Zetek), Bugaba, Prov. Chiriqui (Champion, Biologia, p. 629), Quipo (J. P. Chapin).

An elongate specimen of *O princeps deceptor* Pils. was recorded from Panama in Manual of Conchology XII, p. 117, pl. 24, fig. 25. It was acquired by A. D. Brown from Luders over fifty years ago, the collector unknown. Some doubt may reasonably be entertained about the locality. Von Martens (Biologia, p. 187) gleaned from previous literature the localities Panama (Cuming), and Islands in the Bay of Panama (MacNeil) for *Ortalichus obductus* Shuttl [= *Oxystyla obducta*] These old records need confirmation. *Orthalicus undatus*, reported by Zetek, 1918, appears from photographs sent to be immature *O princeps* There is a rather peculiarly marked form on Taboga Island (Zetek), I have seen only a young specimen, the exact race of which remains uncertain

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[1] The type of *Drymæus* is *D hygrohylæus* (Orb.), of Bolivia. In an extensive Mexican group of species the lip is similarly expanded, the subgenus *Goniognathmus* Fisher & Crosse, Miss. Scient. Mex., Moll. I, 1875, p. 473, with the type *D lattrei* (Pfr.), has been provided for them. Whether this group is separable from *Drymæus* proper appears doubtful, and can hardly be determined until the type of *Drymæus*, or some closely related species, can be dissected.

The Andean "group of *D farrisi*" of my Classification of Bulimulidæ, page xliv, in Manual of Conchology, 1902, seems rather distinct. The new section *Orodrymæus* is proposed for it, type *D farrisi* (Pfr.).

[20] Die Heliceen, 1850, p. 157. *D virgulatus* (Fér.), (*elongatus* Bolton) was named as type by von Martens, 1860.

[21] Miss. Arc. Mérid. Equat. Amér. du Sud, 1899–1906, IX, Zoologie, 1910, p. C43. *D inusitatus* Fult. is here designated type of *Antidrymæus*.

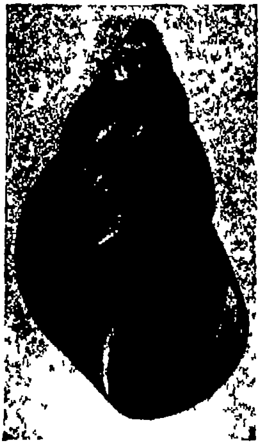

Fig 18 —*Oxystyla princeps*, Quipo

ACHATINIDÆ

Our species are small, turrited or high-conic shells, somewhat transparent, usually clear gray or yellowish gray, glossy, either nearly smooth, lightly striate or with thread-like riblets *Subulina* and *Opeas* are often seen to contain relatively large white eggs before attaining much more than half the full size of the species, also, the maximum size varies in different colonies

Key to Species

1	Columella distinctly truncate below (obliquely or abruptly)	2
	Columella concave below, curving into the basal margin, not sinuate or truncate	7
2	Slender, length of aperture less than one-third that of the shell, which is 12–23 mm. long	*Subulina octona*
	Stouter, more broadly conic, with aperture occupying more than one-third the length of the shell	3
3	A parietal lamella present; length 10–15 mm (fig 19 *a*)	*Leptinaria lamellata concentrica*
	No parietal lamella ..	4
4	Surface having thread-like striæ	5
	Smoother, the striation weak and fine	6
5	Columellar lamella well developed (fig 19 *l*)	*Leptinaria interstriata*
	Columellar lamella weakly developed (fig 19 *d, e, k*)	*Leptinaria filicostata.*
6	Form wider; columella abruptly truncate below (fig 19 *h, i, j*)	*Leptinaria panamensis.*
	Form narrower, columella very obliquely truncate below (fig. 19 *f, g*)	*Leptinaria costaricana.*

Shell of short, closely coiled, more or less ribbed whorls, about 8 mm long, 8½ whorls (fig 21 *d*) *Opeas beckianum.*
7 Whorls not so short, more or less ribbed, form narrower (fig 21 *c*) *Opeas micra*
Whorls longer, merely finely striate 8

Small and slender with straightly conic spire and fine, well curved striæ, outer lip strongly retracted
8 towards its upper insertion, about 5 mm long, of 5½ whorls (fig 21 *b*) *Opeas pumilum*
Larger species 7 to 10 mm long, with more whorls 9

Spire straightly tapering, striæ decidedly arcuate, becoming slightly stronger, "gathered," below the suture, aperture rather narrow, 8 5 mm long, 7½
9 whorls (fig 21 *a*) *Opeas gracile*
Spire somewhat thicker, striæ finer, less arched, not puckered below suture, 8 9 × 2 mm , 8½ whorls *Opeas adamsi.*

Subulina octona (Brug)

Sansan Creek, Prov Bocas del Toro, Tonosi, Los Santos Prov (A A Olsson) Ancon, Panama City and Taboga Island (J Zetek)

Part of the specimens of this common species from Panama City and Tonosi Creek are the very long form *trochlea* Pfr , up to 23 mm long, of 11½ whorls, the ordinary length is 13 to 16 mm

Leptinaria lamellata concentrica (Reeve) Text-fig 19 *a, b, c*

Tonosi, Prov Los Santos (Olsson), Panama City, near Darien and Taboga Island (J Zetek), Gatun (D E Harrower) and between Tabernilla and San Pablo, C Z (A P. Brown)

This is the largest Panamic *Leptinaria*, and the only one possessing a parietal lamella The form with irregularly spaced, thread-like axial riblets, known as var *concentrica*, is the prevalent form, though some of the specimens from Taboga Island approach the smoothish typical form of the species Panamic specimens seen are from 8 to 11 mm. long, but it is known in some places to run up to 15 mm

Leptinaria interstriata (Tate) Text-fig 19 *l*

Man. Conch XVIII, p 310, pl 41, fig. 12.

Island in the Lagoon of Bocas del Toro (Tate)

A cotype received from Tate is figured It differs from *L filicostata* chiefly by the stouter figure and the much stronger columellar lamella The riblets are slightly more widely spaced

The specimen figured measures length 7 8 mm , diam 3 6 mm , aperture, length 3, width inside 1 7 mm , or including columellar lip, 2 25 mm , 6½ whorls

Leptinaria filicostata (Strebel & Pfeffer) Text-figs. 19 *d, e, k.*

Lamellaxis filicostatus Strebel, Beitrag Mex Land- und Süsswasser-Conch , V, 1882, p 113, pl 17, fig 10 (San Miguel Jucumó, Guatemala)

Between Tabernilla and San Pablo and at Los Cascades, C Z (A P Brown) Taboga Island (J Zetek)

The shells identified as this species are not so widely conic as *L. interstriata* (Tate), and the columellar truncation is *much less abrupt* The columellar lamella is very low in the adult specimens, slightly stronger in younger ones, such as fig 19 *e* The outer lip is distinctly thickened within in the fully adult stage,

Two specimens measure

Fig 19 *d* Length 8 3 mm , diam 3 75 mm , aperture, length 33, width 1 7 or including columellar lip, 2 4 mm , 6¾ whorls Between Tabernilla and San Pablo, C Z

Fig 19 *k* Length 7 3 mm , diam 3 4 mm , aperture 2 75 × 1 5 (1 9) mm , 6½ whorls Taboga Island

I have not been able to compare Guatemalan specimens of *filicostata* From the figures and measurements given by Strebel it appears that it has a slightly shorter aperture than the Panamic specimens 'As the difference seems very small, I assume that they are of the same species.

Leptinaria costaricana von Martens. Text-fig 19 *f, g*, 20 *b*

Biologia, p 320, pl 18, fig. 15 (San José in central and various places in southwestern Costa Rica)

Fig 19 —A, B, C, *Leptinaria lamellata concentrica.* D, E, *L filicostata*, nr Tabernilla. F, G, *L costaricana*, Tonosi. H, I, J, *L panamensis.* K, *L filicostata*, Taboga. L, *L interstriata*, cotype, Nicaragua × 2¼

Tonosi, Los Santos Province (A A Olsson)

This species stands close to *L panamensis* but differs by the shape of the columellar lamella, which is lower and evenly curved from its emergence to the lower end This shape is clearly shown in von Martens' figure, also in our fig 20 *b* In *L panamensis* the lamella is noticeably stronger, and its curvature is decidedly more abrupt near the lower end, giving the columella a truncate appearance The whole shell in *L panamensis* tapers more rapidly from a perceptibly wider last whorl In both species, the fully adult shell has a rather broad but slight callous thickening within the lip While the two species are rather similar, the peculiarities mentioned enable one to separate mixed lots without difficulty

One of the shells from Tonosi measures

Length 9 4 mm , diam 3 7 mm , aperture length 3 3, width inside 1 5, including columellar lip 2 2 mm , 7 whorls (fig 20 *b*)

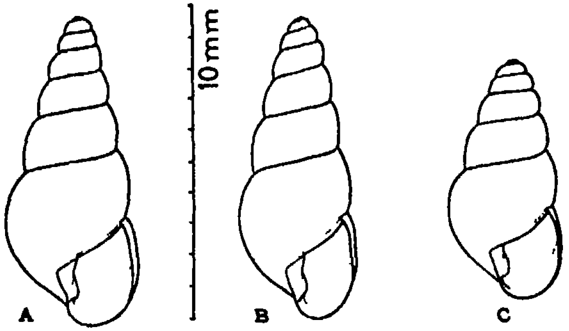

Fig. 20 —A, *Leptinaria panamensis* B, *L costaricana*, Tonosi C, *L panamensis* var , Taboga I

Leptinaria panamensis Pils Text-fig 19 *h*, *i*, *j*, 20 *a*, *c*.

Proc A. N S Phila., 1910, p 508, fig 4.

Between San Pablo and Tabernilla (type loc.; A P Brown), Balboa, C. Z. (J Zetek) Panama City (J Zetek); Tonosi, Prov. Los Santos (A. A. Olsson)

Readily separable from *L costaricana* by the broader cone of the spire and the stronger columellar lamella. The type lot consists of numerous rather small specimens only, but eggs are seen in the penult whorl, shining through the shell In the largest specimens from Tonosi, fig. 19 *i*, the lip is distinctly thickened within Those from Panama City, fig 19 *j*, are also large

Fig 19 *h* Length 8 mm , diam 3 5 mm , aperture 3 2 mm long, 2 2 mm wide (incl columellar lip), 6¾ whorls Paratype

Fig 19 *i* Length 9 4 mm , diam 4 0 mm , aperture 3 3 mm. long, 2 5 mm wide (incl columellar lip), 7 whorls Tonosi

Fig 19 *j* Length 9 0 mm , diam 4 0 mm , aperture 3.4 mm. long, 2 5 mm wide (incl columellar lip), 6¾ whorls Panama City.

On Taboga Island Zetek collected many examples of a slightly more broadly conic form, fig 20*c*, the figured one 'measuring length 7 3 mm , diam 3 5 mm , aperture 3 mm long, fully 6 whorls

Opeas pumilum (Pfr) Text-fig 21 *b*

Opeas goodalli Miller, Pilsbry, Man. Conch , XVIII, p 200.

C Z Los Cascades (A P Brown), near Darien (Zetek) Bocas del Toro Prov (Ralph Tate), Panama City (J Zetek)

Small, rarely over 6 mm long, with slender, straightly conic spire, the outer lip *strongly retracted* to its upper insertion, striation fine The shell figured is 5 mm long, of 5½ whorls

Opeas gracile (Hutton) Text-fig 21 *a.*

Man Conch , XVIII, p 198

Quipo (J P Chapin), Panama City (Zetek)

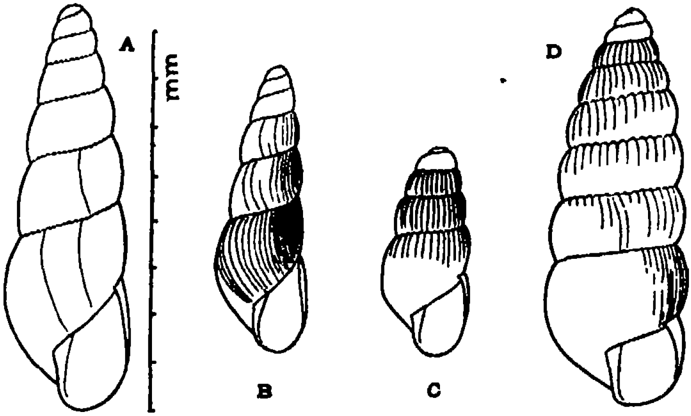

Fig 21 —A, *Opeas gracile*, Quipo B, *O pumilum* C, *O micra.* D, *O beckianum*, Taboga I

Known by the rather straight, long spire, the very equable and moderate convexity of the whorls, the distinct, *arcuate* striation, usually stronger and a little puckered below the suture, and the long aperture The example figured is 8 5 mm long, of 7½ whorls

It is very widely spread in the tropics of both hemispheres Listed as *Subulina mimosarum* d'Orb in Zetek's 1918 Catalogue

Opeas adamsi Pils

Man Conch , XVIII, 1906, p 216, pl 50, fig. 18

Panama (C B Adams)

This was inadvertently referred to as *Opeas panamense* Pils in Proc A N S Phila 1910, p 503 It has a thicker spire than *O gracile* with very fine, less curved striæ Length 8 9 mm , 8½ whorls I have seen only the single specimen contained in the Adams collection in the University Museum at Amherst

Opeas micra (Orb) Text-fig 21 *c*

Manual of Conchology, XVIII, p 193

Island in the lagoon of Bocas del Toro, in forest (R Tate for *Bulimus tryonianus*) Canal Zone between Tabernilla and San Pablo (A P Brown), and near Darien (J Zetek)

It is somewhat intermediate in form between *O gracile* and *O. beckianum* Perforate, with very obtuse summit, more or less *ribbed* on the spire, the riblets threadlike Size variable, 4 mm long with 5 whorls, to 6-9 mm with 7 or 8 whorls

A variety *tryonianum* (Tate) has been distinguished, but specimens seen which were received from Tate do not appear to differ materially from many lots of *O micra*, and I am inclined to discard the name

Opeas (Synopeas) beckianum (Pfr) Text-fig 21 *d*

Drift of San San Creek, and Mono Creek, Prov Bocas del Toro, Tonosi, Prov Los Santos (A A Olsson), Taboga Island (J Zetek)

Known by the very short, strongly convex whorls, more or less ribbed The figured specimen measures 8 mm long, 8½ whorls

GLANDINIDÆ

Euglandina dactylus (Brod) Plate X, figs 1, 2

Rio Puerco, Prov Panama and near Lagarto, Prov Colon, (A A Olsson), between Tabernilla and San Pablo (A P Brown) Near Cartagena, Colombia (Lloyd B Smith)

The shell is fusiform, with concavely tapering spire, slender above, below the periphery the last whorl tapering, slightly convex, thin but rather strong, periostracum thin, opaque cinnamon to cinnamon-brown in color, where deciduous showing the light pinkish cinnamon under color Surface dull, except the early whorls which are glossy. First whorl flattened above, convex, smooth, the second convex below the suture, also smooth, following whorls are evenly, weakly convex. About the middle of the third whorl impressed spiral lines appear, weakly at first, soon becoming more deeply bitten, about 10 at the end of the third whorl, a few more on the later whorls, these lines becoming obsolete on the penult whorl About the middle of the fourth whorl axial striae appear weakly, on the penult and last whorls the striæ become regular, strong, and crossed by extremely fine, close spiral striæ The suture is but weakly impressed, with a narrow margin below, bounded by an impression which is deeper on the intermediate whorls The aperture is very narrow. Outer lip arching forward somewhat in the middle, regularly curved Columella gently concave, abruptly truncate

Length 63 mm , diam 24 3 mm , length aperture 32 mm., 7½ whorls

This fine species is related to *E striata* Müller, *E striatula* Vernhout,[22] described from Lawa, Surinam, and perhaps also to *E venezuelensis* Preston,[23] from Merida, Venezuela, but it differs from all in various details, particularly in the sculpture of the early whorls

The locality of *Helix striata* Müller was not known. The figure [24] would apply to either of the races of the *striata* complex E von Martens in 1860 defined three forms, *striata* Müll., *dactylus* Brod and *strigosa* v Mart. He restricted *striata* to the form without spiral striae—that is, I suppose, without very distinct spirals Miller[25] recognized this distinction and figured as *Glandina dactylus* Brod an Ecuador specimen having spiral lines This species was originally described from Tumaco Island, near the Colombia-Ecuador boundary. Miller's form agrees with Reeve's[26] figure of *dactylus* in having the upper whorls very slender, a character noticeable also in Strebel's figures of shells from Sonson, Colombia.[27]

In his latest consideration of the subject von Martens[28] united all the forms under *G. striata*, but it appears to me that two species or very distinct races, distinguishable by characters of the sculpture and shape of the columella, are involved I have not enough definitely located material to work the problem out. Our Panamic form agrees best with the figure of *E dactylus* Brod , but differs by the slightly less slender early whorls In the absence of topotypes of *dactylus*, for comparison, a full account of the Isthmian form is given above, with figures

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[22] Notes Leyden Mus., XXXVI, 1914, p 5.
[23] Ann. Mag. N H. (8), III, 1909, p 508
[24] Syst Conchyl, Cab IX, pl. 120, fig. 1030
[25] Malak Bl. XXV, p 160
[26] Conch Syst , II, pl 179, fig. 16.
[27] Beitrag Mex , II, pl 7, fig. 15 *d*, *e*. *f*
[28] Biol Centrali-Amer , Moll , p. 79

Euglandina gigantea n sp Plate X, fig. 8 plate XI, figs 5 6, 7

This species will be described on p 128. It is apparently what Strebel reported and figured from Chiriqui as *Glandina sowerbyana* Form B Also the species reported under that name from Chiriqui by von Martens (Biol Centr Am, Moll, p 55) was, I presume, *E gigantea*, the Costa Rican species, and not the true *E sowerbyana* of Mexico I have not seen Chiriqui examples

Euglandina cumingi (Beck) Plate X, figs. 3, 4

Panama City (J Zetek and others), between Tabernilla and San Pablo (A P Brown), Tonosi, Prov Los Santos (Olsson), Chiriqui (Schlüter, Biologia, p 611)

The very regular and fine striation of this species is poorly represented in the figures .

This is the most widely spread *Euglandina* of Middle America *E carminensis* (Morelet) of Zetek's list, 1918, seems from a photograph sent, to be *E cumingi* A dead specimen of *E cumingi* was picked up by Hebard and Rehn at Puerto Colombia, Dept Atlantico, Colombia Dead shells were taken on the hill "La Popa," near Cartagena, by Professor A P Brown, and it is known from some places in Venezuela [29]

`The figures of Férussac, which Beck refers to, represent a large form with short spire, such as is common in some Nicaraguan localities, where, however, more lengthened shells also occur Measurements in mm follow

Length	63 0,	diam.	24,	length aperture	32 5	Polvón, Nicaragua.
"	55 0,	"	25,	" "	33 0	" "
"	42 5,	"	18,	" "	23 0.	Panama City
"	40 0,	"	17,	" "	22 0	Tonosi

Euglandina chiriquiensis (Da Costa) Text-fig 22 *b*

Glandina chiriquiensis Da Costa, Proc Malac Soc, London, IV, 1900, p 66, pl 7, fig 2
Glandina chiriquiana v Martens, Biologia, p 612
Euglandina chiriquiensis Pilsbry, Man Conch, XIX, p 202.

Chiriqui (Da Costa).

A small species, differing from *E aurantiaca* by having the outlines of the spire nearly straight, not concave, and the axial striation is slightly stronger There are fine spiral lines

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[29] H. B Baker, Occ. Pap Mus. Zool. Univ Mich, No. 156, 1925, p. 43

Length 19 5 mm , diam 9 0 mm , aperture 9 0 mm , 5 whorls (Da Costa)

Length 20 2 mm , diam 9 2 mm , aperture 9 8 mm , 5½ whorls (paratype, figured)

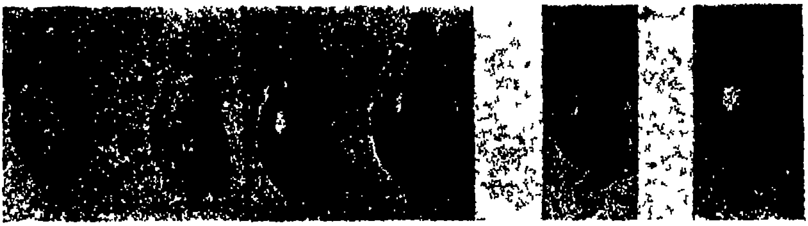

Fig. 22 —A, *Euglandina broctontomlini*, type and paratype B, *E chiriquiensis*, Chiriqui C, *Streptostyla viridula*, Mona Creek D, *Euglandina aurantiaca*, Bocas del Toro

Euglandina aurantiaca (Angas) Text-fig 22 *d*

Glandina aurantiaca Angas, Proc Zool Soc London, 1879, p 480, pl 40, fig 8

Panama "Boca del Toro, South America" (R Swift coll "from Mr Duff of Jamaica," 24808 ANSP)

E aurantiaca was described from one example collected in Costa Rica "from the hilly country" by W M Gabb

Mr J R LeB Tomlin has kindly compared various specimens with the type in the British Museum, 79 7 22 34 of the register He says of it "one example (*dedit* Angas), very smooth, shining, polished and immature, of a warm fulvous color, columella within has a distinct pinkish-orange tinge There is no trace whatever of fine spirals, with a very strong (platyscopic) lens one seemed in some lights to glimpse traces of one or two stronger spirals on the body-whorl, but it was rather doubtful I think that your pair from 'Boca del Toro' are this species They are much less polished, larger and broader, more bleached, but all this might be due to condition I have three good examples of *aurantiaca* from Costa Rica "

The specimens here figured have much the appearance of *E. broctontomlini*, the spire being somewhat concavely conic and the summit quite obtuse, but they differ by the more concave columella and by the entire absence of fine spiral lines. The margin below the suture, distinctly defined by an impresssed line, is narrower than in *E broctontomlini*. Both are bleached white

Length 23 mm , diam 10 5 mm , aperture 12 mm , 6 whorls
" 22 " " 9 8 " " 11.3 " 6 "

Euglandina broctontomlini new species. Text-fig 22 a

Glandina isabellina Pfr , var , Angas, Proc Zool Soc London, 1879, p 480

Costa Rica· without more definite locality (W M Gabb) Vesta Farm, Estrella Valley, type locality (J A G Rehn, 1923) Cahuita, and Rio Jiminey at 50 ft elevation (A A Olsson) Panama: Mono Creek, Prov Bocas del Toro (A A Olsson)

The shell is oblong-conic, thin but moderately strong, between chamois and pinkish-buff (but varying somewhat in tint in different examples), very glossy, with sculpture of light, irregular axial striæ and very fine, close, delicately engraved spiral lines The summit is very obtuse, spire with noticeably concave outlines, the individual whorls weakly convex The last whorl is rather ventricose, its basal slope convex The nearly even suture has an impressed margin. The aperture is rather wide in the lower half, with obliquely truncate basal outline The outer lip is slightly straightened, thin but with a smooth finish The columella is slightly concave, the truncation very close to the base

Length 28 8 mm , diam 12 5 mm , aperture 14 7 mm. 6½ whorls Type

Length 29 mm , diam 11 7 mm , aperture 13 8 mm. 6½ whorls Paratype

Length 31 3 mm , diam 13 6 mm , aperture 16 8 mm Cahuita
" 25 3 " " 11 2 " " 12 6 " Rio Jiminey.

Length 30 7 mm , diam 13 mm , aperture 15.5 mm. Mono Creek.

The glossy surface, concavely tapering spire with obtuse apex and the rather ventricose last whorl are its more conspicuous characters It differs from *E. aurantiaca* (Angas) by the presence of very fine, close spiral lines, wanting in Angas' species

Euglandina isabellina (Pfr), to which Angas referred some of Gabb's specimens of this species as a variety, is an excessively rare form of which von Martens writes that all of the references in the literature "seem to refer to one shell, figured by Reeve,[30] and probably not full grown " J R LeBrocton Tomlin writes of the B M type of *isabellina*

"Type and another exactly similar, from Mus. Cuming Type measures, length 26 mm , diam max 10 mm ; a long, narrow, white shell with unusually narrow aperture and extremely fine, close spirals It broadens very little towards the base " The locality given for *isabellina* is "Mexico," on Cuming's authority.

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[30] Conch. Icon , Achatina, pl 21, fig. 95

Salasiella browni Pils

Proc A N S Phila, 1910, pp 503, 508, fig 5

Las Cascades and between Tabernilla and San Pablo, C Z (A P Brown)

Euglandina-shaped, subcylindric, polished, 10 2 × 4 to 12 × 4 5 mm

Streptostyla viridula Angas. Text-fig 22 c, page 96

Mono Creek, Prov Bocas del Toro (Olsson).

Somewhat larger than the type from Costa Rica An important character of the species is that the suture is followed by a smooth band about ½ mm wide, then a zone about 2 mm wide of close, even, axial striæ This sculpture is best developed in large individuals It is seen in the type specimen as well as in the Panamic. The shell figured measures· length 22 5 mm , diam. 12 5 mm . 7½ whorls

Streptostyla chiriquiana v Martens.

Streptostylus flavescens Da Costa, Proc Malac Soc London, IV, 1900, p 66, pl 7, fig. 1 Not of Shuttleworth, 1852
Streptostyla chiriquiana v Martens, Biologia, p 615, new name for *S flavescens* Da C (January, 1901) Pilsbry, Man Conch , XIX, p 151
Streptostylus pallidus Da Costa, Proc Malac Soc London, IV, p 185, new name for *S flavescens* Da C (March 19, 1901)

Chiriqui (Da Costa)

By shape and size this form, which I have not seen, is very close to *S viridula*. Da Costa does not mention a striate zone below the suture, such as *S. viridula* has, but it may have been overlooked, and in that case the form could hardly be anything but a synonym The size is given as 22 × 11 mm , aperture 11 mm

STREPTAXIDÆ

Gulella bicolor (Hutton) Text-fig. 23

Taboga Island, Panama City and Ancon (J Zetek)

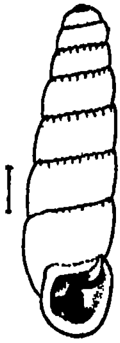

Fig. 23 *Gulella bicolor*, Taboga I.

This small, toothed oriental-region snail is very unlike any American species Originally described from India, it is now widely spread in the tropics It is common around Havana and was taken last year at Manáos, Brasil.

PHILOMYCIDÆ

Pallifera costaricensis (Mörch)

Philomycus costaricensis Mörch, v Martens, Biologia, p 346 (Central Costa Rica at 2000 ft)

Philomycus costaricensis (Mörch) variety *a*, Cockerell, Nautilus, XXVII, May 1913, p 3

Bocas del Toro (E Bethel)

Slugs in which the mantle covers the whole upper surface and the sole is undivided Cockerell described alcoholic examples as "About 11 5 mm long, very pale ochraceous, the mantle with very sparse gray floccose markings and a pair of subdorsal gray bands, irregular in outline and more or less interrupted, consisting, in fact, of crowded gray spots" The jaw has 5 or 6 broad ribs grouped in its middle third. Teeth about 21 13 1 13 21, the central ones strongly tricuspid

LIMACIDÆ

A slug resembling the northern *Agriolimax* was collected by Zetek at Boquete (Chiriqui), Feb 14, 1914, at an elevation of 3500 ft. The specimens, sent to U S N M, have not been determined Not seen by me

ZONITIDÆ

The Panamic forms have small, glossy, more or less transparent shells In the following key the Scolodontidæ, having similar shells, are also included

KEY TO ZONITIDÆ AND SCOLODONTIDÆ

1	Spire elevated, conic, with subangular periphery, umbilicus merely perforate or closed, surface with very fine spiral lines	2
	Spire merely convex or nearly flat, form depressed, with rounded periphery, base umbilicate	3
	Spire a little sunken, small, umbilicus very broadly open, diam 2.5 to 3 mm	*Drepanostomella stolli*
2	Diameter about 2 5 mm	*Guppya gundlachi.*
	Diameter about 6 5 mm , height 5 3 mm	*Euconulus browni*
3	Umbilicus very broad, shell measuring about 4×10 to 11 mm.	4
	Umbilicus small; size much smaller, no spiral striation ..	5
4	Upper surface of individual whorls rather strongly convex. . . .	*Scolodonta zeteki.*
	Upper surface of individual whorls flat	*Scolodonta antoni.*
5	Sculpture of fine growth wrinkles and grooves, diam. 4.5 mm. . .	*Zonitoides hoffmanni.*
	Sculpture very faint, diam. 3 3 mm	*Zonitoides ostauri.*

Guppya gundlachi (Pfr)

Between Tabernilla and San Pablo (Amos P Brown), Barro Colorado Island and Juan Mina, C Z (J Zetek) Panama City (Zetek)

There are very fine spiral lines traced on a nearly smooth glossy surface

Euconulus browni (Pils.)

Guppya browni Pilsbry, Proc A N S P, 1910, p 509, fig 6
Euconulus browni (Pilsbry), H B Baker, Occ Pap Mus. Zool Univ Mich No 156, 1925, p 11

Between Tabernilla and San Pablo, C Z (Amos P Brown)

This species has extremely fine, close, thread striæ, as in the northern forms of *Euconulus*, superficially cut by many impressed spiral lines, both microscopic

Zonitoides ostauri n sp Text-fig. 23

Drift of San San Creek, Prov Bocas del Toro, Type 140714 ANSP, collected by A A Olsson

The shell while smaller is shaped much as in *Z arboreus*, umbilicate, the umbilicus contained about 4½ times in the diameter Pale grayish translucent The spire is moderately convex, of nearly 4 slowly increasing whorls, the first one being relatively wide, the last rounded peripherally The suture is moderately impressed, by transparence showing a narrow margin below The glittering surface is nearly smooth, with extremely weak growth-wrinkles and no spiral sculpture The aperture is rather depressed, deeply lunate, the columellar margin of the peristome somewhat dilated

Height 1 65 mm , diam 3 3 mm

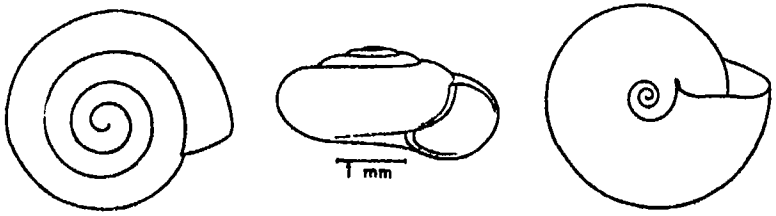

Fig 24 —*Zonitoides ostauri.*

While the generic allocation of small zonitid snails is generally perilous when only the shell is at hand, this form appears to have the characters of *Zonitoides* It is much smoother than *Z. arboreus*, in which immature shells of the size of *Z. ostauri* have fewer whorls and are less depressed. None of the Costa Rican species described under *Hyalinia* appears very closely related to this new form

Zonitoides hoffmanni (v Martens)

Hyalinia hoffmanni v Martens, Biologia, p 115

Canal Zone (H E Wetherell), Boquete, Chiriqui Prov (J Zetek)

The specimens measure 4 5 mm diameter, agreeing with some from Costa Rica, but are smaller than the type I have not been able to compare with the typical form from Costa Rica, which is stated to have a diameter of 6 mm

This form was at one time identified as *Hyalina pauciliirata* v Mart , a Costa Rican species

SCOLODONTIDAE

Scolodonta zeteki Pils Text-fig 25

Proc A N S Phila , 1920, p 195, fig 1

Canal Zone Gatun (D E Harrower), Barro Colorado Island and Gamboa (J Zetek)

Discoidal with nearly flat spire, the whorls with *rounded* upper surface and periphery, broadly umbilicate, glossy, the type measuring. height 4 mm , diam 10 9 mm , 6 whorls

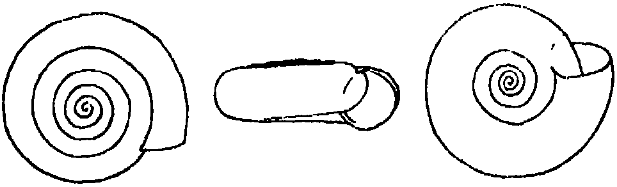

Fig 25 —*Scolodonta zeteki*, type

Scolodonta antoni (Pfr)[31] described from Panama, must be close to this species, as H Burrington Baker[32] has noticed It is described as having the spire a little convex, of 5½ *flat* whorls, the last whorl obsoletely angular, otherwise apparently like *S zeteki* Height 4 mm., diam 10 mm The type, in Anton's collection, has not been figured

Drepanostomella stolli (v Mart)

Reported from Boquete, 3500 ft by J Zetek I have seen Costa Rican examples, but none from Panama

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[31] *Helix antoni* Pfr , Symbolæ II, 1842, p 22

[32] Occas. Pap Mus Zool Univ Mich , No 156, 1925, p 30

SUCCINEIDÆ.

Succinea lutosa n. sp Text-fig. 26

Taboga Island, Panama City, on papaia; Alhajuela, C Z, type loc (J Zetek)

The shell is small, ovate, very pale yellowish, becoming more or less whitish on the latter part of the last whorl, somewhat shining when cleaned, with very fine, light and unequal wrinkles of growth, and under the microscope seen to be minutely granular, the granules weak, close, mainly irregular, but in places indistinctly arranged in oblique lines. Spire short, the whorls strongly convex, the suture deep Aperture quite oblique, occupying about 75 per cent (66 to 76 p c) of the total length In life the shell is copiously daubed with dirt.

Fig 26 —*Succinea lutosa*, Alhajuela.

Length 6.2 mm, diam. 4 mm, aperture 4 7 mm. 2½ whorls Type
Length 6 75 mm, diam 4 mm, aperture 4 5 mm
" 7.3 " " 4 75 "
" 5 4 " " 3 5 " 2½ whorls Taboga Island

This is a small cœnose species, similar to the North American *S. avara* Say, and the Antillean *S. riisei* Pfr I have not compared topotypic *S. riisei* from Porto Rico, but numerous examples from St Croix so identified differ from the Panamic form by the relatively shorter aperture and the granulation, which is even less distinct than in *S. lutosa* These differences, and the fact that the Panamic fauna has little in common with that of the Virgin Islands and Porto Rico, influence me to propose a new name for our snail I formerly thought that it might be *S. brevis* Dunker, from central Mexico, but the figures of that species published by von Martens (Biologia, p 339, pl 19, fig 7), representing one of Dunker's original specimens, do not favor this determination Mexican specimens identified as *S brevis* which I have examined do not show the peculiar surface sculpture of *S lutosa* *S brevis* inhabits a very different faunal zone. Possibly, if abundant material from intermediate localities becomes available, some of these small species of the *avara* group may be united, but it appears best, under the circumstances, to have a special name for the Panamic form

Succinea panamensis Pils. Text-fig. 27

Proc A N S Phila. for 1919, p 218, pl 11, fig. 4, 1920

Panama (Capt Field) Las Cascades, C Z (A. P Brown)

Fig 27 —*Succinea panamensis* × 2

PUPILLIDÆ

Gastrocopta servilis (Gld) Text-fig 28 *a*.

Panama (Paz), Juan Mina and Barro Colorado Island, C. Z (J Zetek)

This very small snail often carries a protective coat of dirt The number and forms of the apertural teeth are characteristic and distinguish it from various allied species which may occur in the region

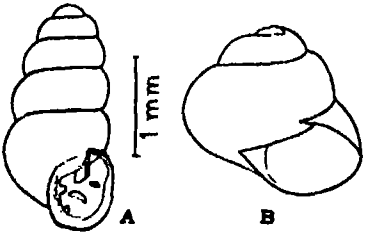

Fig 28 —A *Gastrocopta servilis* B *Pupisoma dioscoricola*

Pupisoma dioscoricola (C B Adams) Text-fig 28 *b*

Man Conch, XXVI, p 36, pl 4, figs 1-5

Juan Mina, C Z. (Zetek)

A thin, brown, very small snail, living on the leaves of various plants, such as the yam, orange and palms Length 1 5 to nearly 2 mm

VERONICELLIDÆ

Vaginulus (Latipes) occidentalis (Guilding)

H B Baker, Proc A. N S. Phila., LXXVII, 1925, p 174, pl 5, fig. 18–20

Panama (R E B McKinney), No 117321 ANSP.

The slugs reported as *Veronicella olivacea* Stearns are probably *V occidentalis* The large flat slugs of this family may be known by the tripartite ventral surface, a broad "hyponotum" appearing on each side of the foot-sole By day they are exceptionally torpid or somnolent creatures, but at night go abroad in the quest of food.

III. SPECIES REPORTED FROM PANAMA, NOT VERIFIED BY THE AUTHOR.

Bulimus fimbriatus Forbes, Proc Zool Soc London, 1850, p 56, pl. 9, fig 7

The shell is more slender than any of those in our fig 21, page 92, measuring 9 × 2 mm , of 7 to 8 convex whorls, thin, "sculptured with somewhat arcuate longitudinal ribs and close parallel [spiral] lines in the interstices of the ribs", reddish brown "Unfortunately less certain as to exact locality, though contained in a box labelled 'Panama'" It was collected during the surveying voyages of the *Herald* and *Pandora* The shells of these voyages were partly mixed, and many of the localities assigned in Forbes' report on them are known to be incorrect

B fimbriatus has been referred to the Antillean group *Melaniella* (*Pichardiella*) by several authors, to *Pseudosubulina*, with doubt, by H B. Baker It should be looked for by collectors around Panama

The following species are among those reported from Panama by James Zetek, in Los Moluscos de la Republica de Panama, 1918, pages 16–18

Succinea dorbignyana Lea. This species, mentioned in Lea's Obs Gen Unio, IV, p 4, does not appear to have been described. Lea states that it was found by d'Orbigny in Colombia, and sent to him as *S putris* So far as I know, this great traveller was never in Colombia The *putris* of his early paper was subsequently described as *S aequinoctialis*, with the locality Guayaquil

Succinea sagra d'Orb

Pseudohyalina cidariscus Martens Boquete

Streptaxis (?) *orbiculata* d'Orb

Tornatellina sp Santa Cruz, cerca de David

Pleurodonte (*Labyrinthus*) *plicata* Born was reported from the Atrato River slope of the Sierra Darien (A E Heighway) by W H Dall, Smiths Misc Coll Vol 52, Part 3, no 1866, p 361 (1909), and thus it may perhaps extend over the range into Panamic territory R Tate in the American Journal of Conchology, V, 1866, p 156, reported *H plicata* from "forest, north shore of Naval Bay, Colon," but I suspect that he had *P otis orthorhinus*, the only *Labyrinthus* positively known from the vicinity of the Canal Zone I have not seen *plicata* from anywhere west of Venezuela

Pupoides modicus (Gld) A single specimen was among shells brought from the Canal Zone by Dr H E Wetherell about fifteen years ago It is just possible that it is a small *P marginatus nitidulus*, not quite mature, but it is exactly like *modicus* I hesitate to include it in the Panama list as its presence in this lot may be adventitious

IV APPENDIX NOTES ON THE CLASSIFICATION OF SNAILS REFERRED BY AUTHORS TO *Microphysa* AND *Thysanophora*

In the course of determining the Panamic species of *Thysanophora* an examination of related continental forms from Mexico to Colombia had to be made The identifications of various lots in the collection were revised, a classified catalogue of the continental forms prepared, and descriptions were drawn up of certain insufficiently known or new species. In the attempt to trace the affinities of continental groups, some references to West Indian forms are essential An extended investigation of the latter is not required for my present purpose, and could not now be undertaken for want of sufficient material for dissection, but it has seemed well to make some record of the results of my work as far as it goes The skeleton arrangement of these helices given below may serve until further anatomical research can establish their classification on a broader basis [32]

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[32] In 1914 the late John B Henderson, Jr undertook studies for a monograph of the *Thysanophora* group Our collection was placed at his service, and a con-

Thysanophora and related genera have been placed in the helicid subfamily Sagdinæ (Pilsbry, 1895), but as there seems to be a tendency among recent malacologists to elevate what we considered subfamilies of Helicidæ to families, it may be well to call the group Sagdidæ The family contains helices of moderate or small size, plain, uniform and generally quite light colored,[33] with the peristome simple and sharp as in zonitid snails In some genera (No 2 to No 6, of the list on page 107), there are internal laminæ or teeth The group as a whole belongs to the fauna of the West Indies, Mexico and Central America, with a few peripheral species in the southern United States and the northern border of South America I do not know of any related family in the Old World.

Typical Sagdidæ, such as *Sagda*, *Hyalosagda*, *Lacteoluna* and *Zaphysema*, have a very long appendix on the penis, as well as a flagellum In other anatomically known genera which are at present placed in this family, there is no appendix, but the penis has a conspicuously glandular flagellum (*Hojeda*), or a glandular epiphallus (*Microphysula*) The kidney is long and narrow in the typical genera, but in some of the minute forms it is only two or three times as long as the pericardium The genital orifice is below the right eye-stalk, or a little further forward Some of the anatomical characters of such genera as have been dissected are utilized to show the general internal classification of the family, thus.

I Kidney bandlike, the length more than 4 times the greatest width, and three to over six times the length of pericardium. (Sagdinæ)
  a Penis very long, provided with a long appendix inserted near the base, and a terminal flagellum, spermathecal duct long
    b Flagellum slender, tubular.
      Zaphysema,[34] *Sagda*, *Hyalosagda*

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siderable series was lent to him, to supplement his own extensive collections The untimely death of this talented conchologist before publishing anything on the group was a loss to science as well as a sorrow to his many friends of the malacological fraternity

[33] Certain species of the genus *Suavitas*, subgenus *Euclastaria*, are banded, but it is not certain that these forms belong to this family.

[34] Just how *Zaphysema* is related to the other genera I am not prepared to say The single individual I dissected (Proc A N S Phila., 1892, p 214, pl 13, fig F) was one of my early land snail dissections. The genitalia appear to have too many appendages, but I have never had opportunity to check up my results. I did not examine the pallial complex. The black integument of *Zaphysema tenerrima* contrasts with the very pale tint found in animals of all other genera examined

b^1 Flagellum flattened, rather wide *Lacteoluna* (*selenina* Gld)

a^1. Penis long, terminating in a slender, tubular flagellum; no appendix, spermathecal duct of medium length and rather large caliber *Suavitas* (*suavis* Gundl)

II. Kidney moderately wide, its length between 2 and 3 times the greatest width, and 2 to 3 times the length of the pericardium. Penis without an appendix, spermathecal duct of medium length, i e , decidedly shorter than the oviduct (Thysanophorinæ)

a Penis very short, with terminal epiphallus and retractor, no flagellum, kidney triangular, about twice the length of the pericardium *Thysanophora* (*hornii* Gabb)

a^1. Penis of moderate length, continued beyond the insertion of the epiphallus, with terminal retractor, epiphallus broad, glandular, no flagellum, kidney about twice the length of pericardium *Microphysula* (*ingersolli* Bld)

a^2. Penis passing into an epiphallus which bears a terminal retractor and a fusiform, glandular flagellum, kidney about 3 times the length of the pericardium *Hojeda* (*vanattai* H B Baker)

At present the following thirteen genera are included in the Sagdidæ:[35]

1 ZAPHYSEMA Pilsbry Type *Helix tenerrima* C B Ad
2 SAGDA Beck Type *Helix cookiana* Gmel [36]
3. PROSERPINULA Albers Type *Helix discoidea* C B Ad
4 ODONTOSAGDA von Martens Type *Helix polyodon* W & M
5 VOLVIDENS J B Henderson Type *Helix tichostoma* Pfr
6. XENODISCULA Pilsbry [37] Type *X venezuelensis* Pils.
7 HYALOSAGDA Albers Type *Helix similis* C B Ad
8 LACTEOLUNA Pilsbry Type *Helix selenina* Gld
9 SUAVITAS Pilsbry Type *Helix suavis* Gdl
  Section *Setipellis* Pilsbry Type *Helix stigmatica* Pfr
  Subgenus *Euclastaria* Pilsbry Type *Helix muncola* Shuttl
  Subgenus *Aquebana* Pilsbry Type *Helix velutina* Lam , Pfr
10 ITZAMNA Pilsbry Type *Helix sigmoides* Morel
11 THYSANOPHORA Strebel & Pfeffer Type *Helix impura* Pfr [38]
  ? Subgenus *Toltecia* Pilsbry Type *T jaliscoensis* Pils
  ? Subgenus *Vilitas* Pilsbry Type *T omissa* Pils.
  ? Subgenus *Strialuna* Pilsbry Type *T diminuta* (C B Ad)[39]
12. MICROPHYSULA Cockerell Type *Helix ingersolli* Bld
13 HOJEDA H B Baker Type *Thysanophora vanattai* H B.B
  ? Subgenus *Aerotrochus* Pilsbry Type *Helix subpyramidalis* C B Ad

Microphysa as originally proposed in 1860 was a nearly natural group, but by the inclusion of further species it became rather heterogeneous[40] As the name *Microphysa* was preoccupied, I transferred most of its species to *Thysanophora*[41] in 1894, but without going over the species critically The list contained several unrelated forms, such as those I have since transferred to *Pupisoma*, and *Helix bactricola* Guppy, which H B Baker has transferred to *Radiodiscus*

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[35] With the exceptions of *Sagda* and *Thysanophora*, all of these genera were either monotypic, or the types were fixed by original designation

[36] On type designation, see von Martens, Die Hel 1860, p 76, Pilsbry, Proc A. N S Phila , LXIII, 1912, p 580

[37] Placed here with considerable doubt

[38] Type designated by Tryon, Man Conch (2), III, 1887, p 16

[39] This species understood as defined on p 117

In my work of 1894,[42] I suggested a threefold division first, the typical Mexican Thysanophoræ, second, the *H. vortex* (*selenina*) group, third, the group of *H stigmatica* and *H suavis*, with which I associated *H sigmoides* from the mainland Work on the anatomy of the species has shown that this division, as far as it went, was correct, but further subdivision of the genus is required

LACTEOLUNA new genus

Depressed, umbilicate, thin, milky-transparent to milky-whitish shells, without periostracal appendages, having the last embryonic

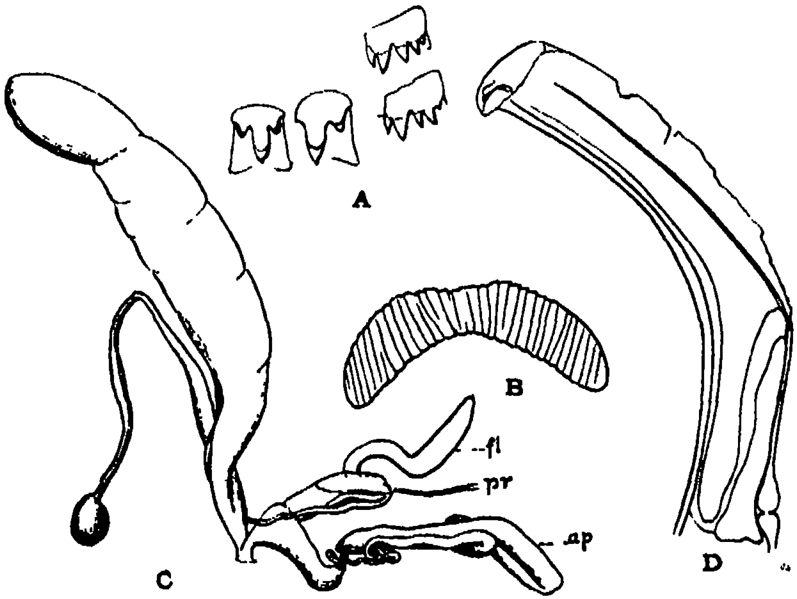

Fig 29 —*Lacteoluna selenina* A, teeth B, jaw C, genitalia. D, pallial organs. *ap*, appendix, *fl*, flagellum, *pr*, penial retractor

whorl engraved with spiral lines, first half whorl smooth Type *Helix selenina* Gould

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[40] As in Pfeiffer-Clessin, Nomenclator Hel Viv 1878, pp 99, 100
[41] Guide to the Study of Helices, Man. Conch , IX, 1894, pp. 54–58
[42] T c p 57

Some Jamaican species such as *L immunda* (C B Ad) and *L ptychodes* (Pfr) attain a relatively large size

The reproductive system of *L selenina* (Gld) from Bermuda, (E G Vanatta coll) is much like that of *Sagda* and *Hyalosagda.* The penis has a terminal vas deferens and flagellum, the latter rather *broad and flattened* The long, slender retractor muscle has its insertion about midway, widening into a sort of thin sheath Close to the base arises a very long appendix, at first stout, then contracting to a small duct, enlarging again and folded lengthwise, bringing the end back near the base It was found folded about the same in a second individual opened The spermathecal duct is very long, and inserted low on the oviduct The upper part of the oviduct or "uterus" is filled with embryos Fig 29*c*

The lung is long and narrow, with no macroscopic venation except the pulmonary vein The narrow kidney is about three times the length of the pericardium The secondary ureter appears as a whitish band with a thread-like ridge near the intestine, and seems to be open throughout [44]

The radula has short, square central teeth with the mesocone nearly as long as the basal plate, ectocones well developed Laterals similar but without entocone In the marginal teeth an entocone is developed by splitting of the mesocone and the original ectocone is bifid or split into three cusps There are 9 10 1 10 9 teeth

The jaw is very thin, composed of numerous flat narrow plates, denticulating the edges Fig 29 *b*

The shell differs from *Hyalosagda* and *Sagda* in various details of structure, but the relationship with those genera seems to be close In the genitalia and the band-like kidney there is little difference However, the flagellum in *L selenina* is a broad, flattened body, somewhat recalling that of *Hojeda*, though simpler in structure, while *Sagda* has the usual type of flagellum, slender and tubular

SUAVITAS new genus

The thin, helicoid shell is rather narrowly umbilicate, with thin, simple or very slightly expanded peristome Embryonic whorls and usually the whole shell have microscopic, shallowly pebbly surface, in the typical forms the later whorls have papillæ or short bristles in more or less regular oblique trends, forward and backward Size moderately large (diam. usually 8 to over 20 mm). Type *Helix suavis* Gundlach

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[44] However, I did not section it, the whitish band may be a thin-walled duct.

A single specimen of *Suavitas suavis* collected on the hill "La Vigia," back of Trinidad, Cuba (H A. P., April, 1904) was dissected The soft parts are cream colored Foot is very long and narrow, as in *Sagda*, evenly granulose, without line at ridge of tail.

The lung (fig 30 *a*) has rather sparse, faint venation. The pericardium is about one-fourth as long as the kidney Kidney band-like, very long (13 mm), its greatest width contained 6 to 7 times in the length. The reflexed ureter is broad, opaque. The secondary ureter is a thin-walled tube

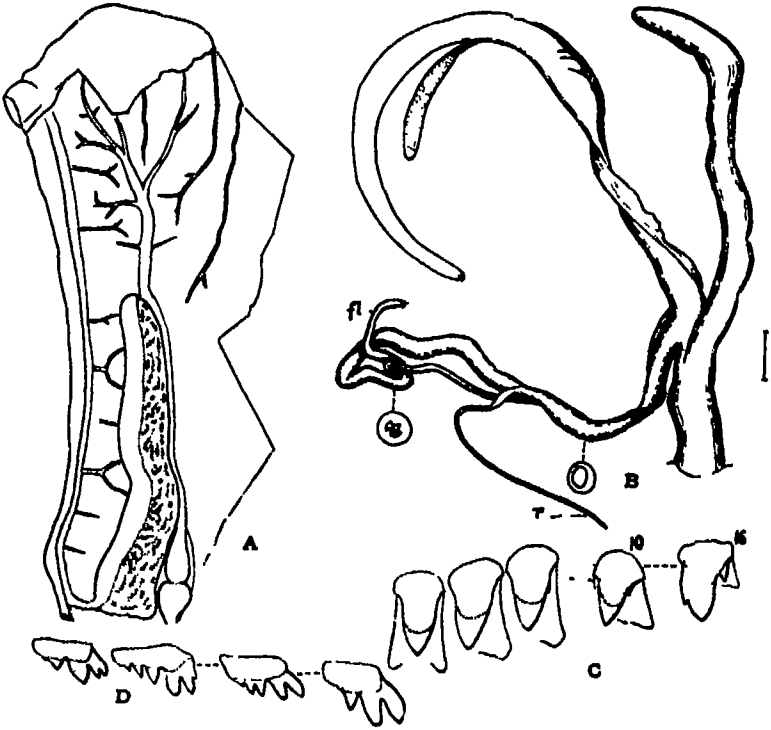

FIG 30 —*Suavitas suavis* A, pallial complex B, genitalia. C, central and lateral, and D, marginal teeth. *fl*, flagellum, *r*, penial retractor

In the reproductive system (fig. 30 *b*), the atrium is capacious and of unusual length, the large, thick-walled spermathecal duct inserted upon it, below the insertion of the penis (an unusual position) It is of medium length, much shorter than the oviduct

The oviduct is large in its lower part, the middle and upper parts relatively undeveloped and flat in the individual dissected (as if protandrous).

The extremely long, slender penis has a simple lumen in the lower half, then some low longitudinal ridges, and in the upper part two low ridges and an acute pilaster It terminates in a flagellum which appears to be rather short, as I could not find the end, which broke or was cut off Above the vas deferens for a short distance the flagellum is similar in section to the penis just below Whether there is an epiphallus was not ascertained certainly, but no definite partition was seen The very long penial retractor is inserted about midway of the penis, and attached to the diaphragm The sperm duct and prostate (stippled in the figure) are free from the oviduct throughout, though lying against it The ovotestis and its duct were broken off

The radula (figs 30 *c*, *d*) has ? 14 1 14 ? teeth,[46] those of the median field decidedly longer than wide, with long, stout mesocones On the second lateral, or in worn teeth much further out, a minute ectocone appears, and about the 16th a minute endocone, high on the mesocone The marginal teeth (fig 30 *d*) are low, wide, with the endocone large, sometimes bifid, ectocone represented by two or three denticles

This genus does not appear very closely related to any of those now known anatomically The penis resembles that of *Sagda* and *Hyalosagda* except that there is *no appendix* The spermathecal duct is large and far shorter than in *Sagda*. The kidney is of the long, band-like type, as in *Sagda* and *Lacteoluna* (*selenina* Gld) The appearance of an endocone on the marginal teeth is also a character of *Lacteoluna*

In typical *Suavitas* the spire is concave and the papillæ begin early on the first whorl In several groups following, presumably subordinate to *Suavitas*, the embryonic 1½ whorls are free of papillæ and the spire is more or less raised

Setipellis, new section Rather large, globose-depressed, the post-embryonic whorls shortly setose Type *Helix stigmatica* Pfr. Cuba

AQUEBANA, new subgenus

Embryonic sculpture coarser than in other sections of the genus Surface of last whorl with peculiar long elevations and periostracal processes Type *Helix velutina* Lam of Pfeiffer, Porto Rico

H. pubescens Pfr of Haiti has similar sculpture of the embryonic whorls, and probably belongs to this section, although the last whorl is shortly hairy

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[46] The radula curled persistently; I could not get the marginal fields straightened out, so the number of marginal teeth is uncertain.

EUCLASTARIA new subgenus

Euclasta von Martens, Jahrb D M Ges 1877, p 347, monotype *Helix muscicola* Shuttl Not *Euclasta* Lederer, 1855

Surface microscopically subgranose, post-embryonic whorls ribbed in the direction of growth lines, spire convex or low-conic, umbilicus narrow, lip sharp and simple, banded, often very indistinctly, at or above the periphery Type *Helix muscicola* Shuttl

Virgin Islands, Porto Rico and Cuba (*H debilis* Pfr) In Haiti this subgenus appears to be represented by *H leucoraphe* Pfr , which differs from the other species by lacking ribs and by the distinct color pattern Pending an examination of the anatomy this Haitian species may be left in *Euclastaria*

This group has a certain resemblance to some species of *Plagioptycha*, and by the simple peristome to *Cysticopsis* Its position remains somewhat uncertain

ITZAMNA[46] new genus

The shell is large for this group of helices, very thin, uniform pale buff or almost white, of few (about 4) whorls, obliquely perforate, the spire concave The second half of the first whorl is much wider than the following whorl The aperture is deeply lunate, ample The peristome is simple, thin, becoming triangularly reflected at the columellar insertion The early whorls have dense, minute, irregularly radial granulo-rugose sculpture, with superposed, spaced, rounded papillæ beginning in the middle of the second whorl Last whorl microscopically granulose, with rounded papillæ regularly disposed in oblique, retractive and protractive trends

Type *Helix sigmoides* Morelet This species was thought by Strebel to be an immature form of the *Helix ghiesbreghti* group E von Martens (1892) placed it provisionally in *Solaropsis*, and in 1894 I listed it under *Thysanophora*. It certainly has much in common with the solaropsid group *Psadara* Miller,[47] particularly with those species having the spire concave and the peristome nearly simple, which I have distinguished in our collection by the subgeneric name *Eupsadara* [48] However, by the texture and color, as well as the sculpture, *H sigmoides* resembles such Cuban species as *Helix suavis* Gundl and *H stigmatica* Pfr , and I suspect that its relationships lie in that direction rather than with the *Solaropsis* group

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[46] One of the names of a Mayan deity Masculine

[47] In *Psadara* the spire is practically level, the initial whorl nearly smooth. Type *Helix selenostoma* Pfr The Costa Rican *H tiloriensis* Angas appears to belong to this genus rather than to *Solaropsis* proper, and will be called *Psadara tiloriensis*, if *Psadara* is generically distinct from *Solaropsis*, as von Ihering and some others have claimed

[48] *Eupsadara*, n subg , has a sculpture of very fine, somewhat irregular radial

THYSANOPHORA Strebel & Pfeffer

Beitrag zur Kenntnis der Fauna Mexikanischer Land- und Süsswasser-Conchylien, IV, 1880, p 30 Tryon, Man Conch (2), III, 1887, p 16, *H impura* Pfr designated type

No species of the typical *T impura* group has been dissected, but *T hornii*, belonging to a series of species I believe to be closely allied to the typical forms, has furnished the following notes and fig 31

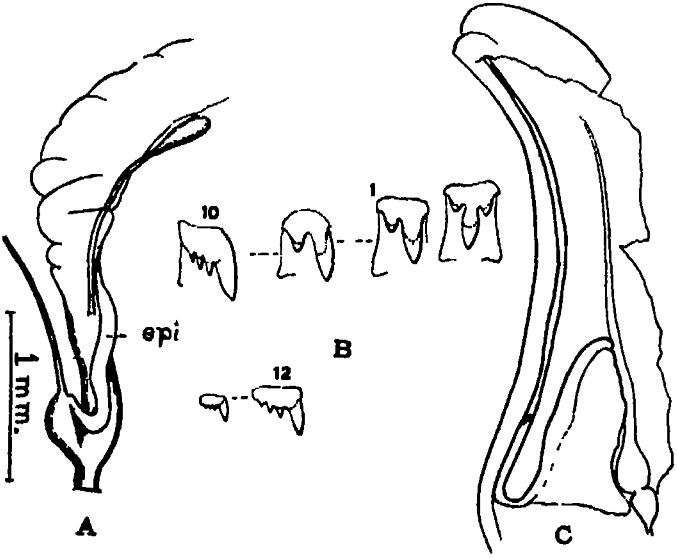

Fig. 31 —*Thysanophora hornii* A, genitalia. B, teeth C, pallial complex *epi*, epiphallus.

In a specimen of *Thysanophora hornii* from Cave Creek, Chiricahua Mts , Arizona, collected by the author, the foot is gray, weakly granular, without an impressed line on the top of the tail or other peculiar features The moderately long lung is plain under ordinary magnification except for the principal vein The kidney is triangular, its length about twice the greatest width, and about twice as long as the heart, it is thin-walled, its lumen is large, the glandular bodies small, mainly transverse The second-

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rugae on the first whorl, the spire is concave and the lip very thin The coloration resembles that of *Psadara* and *Solaropsis* Type *Psadara cearana* Fred Baker, Proc. A N S. Phila for 1913, p 634 ary ureter is closed near the base, but its greater part appears to be open, bounded by a thread-like ridge

The right ocular retractor passes between penis and vagina The penis is very short, about 0 4 mm , with terminal retractor muscle and epiphallus, the latter at least 2½ times as long as the penis. The penial retractor is quite long and inserted on the diaphragm The vagina is rather large and quite long, double the length of the penis Spermathecal duct of medium length, slender

The radula has 8 8 1 8 8 teeth The centrals are tricuspid, laterals bicuspid The marginals have a long, simple inner cusp (mesocone) and three to four ectocones In the absence of endocones on both lateral and marginal teeth this radula resembles that of *Microphysula*, and differs from *Hojeda* and *Lacteoluna*

The typical group of *Thysanophora* is characterized by a sculpture of oblique threads more strongly retractive than growth lines They appear about midway of the first whorl, or slightly earlier, and are well developed and closer on the last embryonic whorl (fig 32) On the following neanic whorl or two they are often indistinct, but on the last whorl they occupy the greater part of the surface Dirt often adheres firmly to the shell, concealing the sculpture This peculiarity suggested the names of some of the species

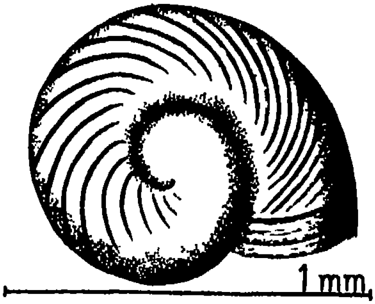

Fig 32 Embryonic whorls of *Thysanophora impura* × 50 Merida.

Distribution is mainly continental, Arizona to Venezuela, but the group is also sparsely represented in the West Indies by *T incrustata* (Poey), which belongs in this subgenus near *T impura*, and by members of the *T. plagioptycha* group

The distribution of the *T plagioptycha* group is anomalous The other species of *Thysanophora* proper are ground snails, harboring under stones, dead wood and the like, areas of species appear to be of moderate extent and continuous in their appropriate zones, in those cases where data are available In some species of the *T. plagioptycha* group the areas are conspicuously discontinuous, both insular and continental, extending from the West Indian islands to the peripheral mainland This would indicate either great age for the species, or some unusual means of distribution, not possessed by other groups of the genus I would suggest that *T plagioptycha* and its allies may live on foliage, as the widely spread Pupisomas are known to do, and thus living individuals may be carried long distances on leaves swept aloft by hurricanes Unfortunately no observations in the field have been made

The species of *Thysanophora* known from the mainland are as follows[49] References are added for species not enumerated in the Biologia Centrali Americana or described in this paper.

(Plagioptycha group)[50]

T fuscula (C B Ad) Jamaica, Mexico

T plagioptycha (Shuttl) Florida and West Indies to Venezuela, Mexico

T cæcoides (Tate) Yucatan and Guatemala to Panama

T. rhoadsi Pils Guatemala Proc A N S Phila 1919, p 217

(Impura group)

T. conspurcatella (Morel) Yucatan

T c puella Pils Panama

T amita Pils. Panama

T balboa Pils Panama

T canalis Pils Panama

T. c. cariacoensis Pils Venezuela

T impura (Pfr) States of Vera Cruz and Yucatan.

T venezuelensis (Jouss) Venezuela

T proxima Pils State of Michoacan

(Paleosa group)

T turbinella (Morel) Guatemala Not seen by me

T. paleosa Strebel and Pfeffer State of Vera Cruz

(Hornii group)

T hornii (Gabb) Arizona to northern Mexico

T heilprini Pils State of Morelos

T. crinita (Fult)[51] Colombia Proc Malac Soc Lond XII, p 240

T c arubana H B Baker, Aruba Occ Pap No 152 p 77

T intonsa Pils Orizaba

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[49] I have made use of the key to Mexican species given by H Burrington Baker, Occ. Pap. Mus. Zool Univ Mich No 106, pp 55–57, with some alterations in grouping All of the mainland species except *T turbinella* (Morelet), *T. rojasi* Jouss. and *T pilsbryi* H B Baker are represented in our collection *T rojasi* requires comparison with *T crinita* and *T venezuelensis*

[50] See Nautilus, XXXIII, p 93

[51] The position of *Trichia rojasi* of Jousseaume is uncertain pending examination of the type specimen

In the *T hornii* group, standing but little removed from those preceding, the oblique threads are less retractive on the embryonic shell than in typical Thysanophoræ, scarcely more so than growth lines, on the last whorl the retractive threads are lacking, but some trace of their influence is discernible in the interruption and sinuosity of the wrinkles of growth, in *T heilprini* they are present in small areas on some examples Sparsely scattered hairs are a special character of the *hornii* group

(Tatei group)

T tatei Pils Nicaragua, Proc A N S Phila 1903, p 764 (1904)

In this group the initial whorl is smooth at first, but in its second half some fine short riblets radiate from the suture, not reaching across the whorl The later whorls are ribbed Position somewhat uncertain, but I think it belongs near the *T hornii* group, and is not directly related to Antillean ribbed species

T pilsbryi H B Baker[32] from southern Vera Cruz, is not autoptically known to me It resembles *T tatei* in being ribbed

In the type of *Thysanophora cockerellæ* Pils [33] The apex is somewhat worn, and no sculpture is discernible In the small form noticed in the original description, which I now call *Thysanophora cockerellæ minima* (height 2, diam 2 4 mm) there are some very faint radial striæ and still weaker, rather well spaced spiral impressed lines on the latter part of the embryonic shell I do not know where to group this species. As the specimens are all "dead" shells, the delicate microscopic sculpture may be imperfect, and in that case fresh material will probably supply a clue

TOLTECIA new subgenus

This group contains minute species in which most of the first whorl is smooth, rather widely spaced spirals appearing on its last fourth, continuing on the following whorl Neanic and last whorls have a sculpture of fine and coarser growth wrinkles and indistinct riblets, and over all very fine impressed spiral lines Type *T jaliscoensis* Pils

Whether this group belongs to *Thysanophora* is uncertain, it has much in common with *Microconus*, but differs by the spiral sculpture of its last embryonic whorl It recalls *Punctum* somewhat I do not think it is related to *Radiodiscus*

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[32] Occas Pap Mus. Zool Univ Mich No 106, 1922, p 54

[33] Nautilus XXVI, 1912, p 12, pl 1, figs 5, 6. Quirigua, Guatemala.

T. coloba Pils Nicaragua Proc A N S Phila for 1893, p 403, figs (Jan 30, 1894)

T. jaliscoensis Pils State of Jalisco See p 124

T. textilis Pils Guatemala Proc A N S Phila Vol 33, 1920, p 196

VILITAS new subgenus

Small, depressed, with the embryonic whorls set with microscopic papillæ not definitely arranged, later whorls with weak, irregular riblets Type *Thysanophora omissa* n sp

Jamaica Systematic position in a high degree uncertain; perhaps it belongs in *Hojeda* or *Lacteoluna*

STRIALUNA new subgenus

The shell is small, discoidal, openly umbilicate, 1½ embryonic whorls have a close, microscopic sculpture of very shallow pits in forwardly and backwardly descending series, or in some places this arrangement is scarcely apparent This gives place abruptly to the later sculpture of regular ribs along growth lines Type *Helix diminuta* C B Ad , of Jamaica

Systematic position uncertain

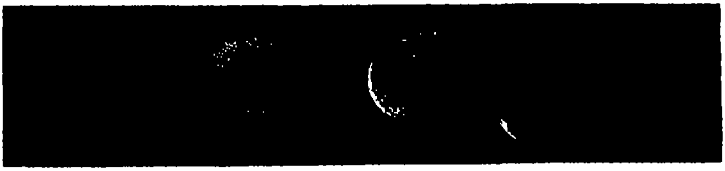

Fig 33 —*Thysanophora diminuta*, St Anns, Jamaica The line represents 1 mm drawn to the same scale as the figure above it

Not being absolutely sure of the identification of C B Adams' species I am giving figures of the form here understood to be *diminuta* It is translucent whitish and measures height 2, diam 3 5 mm On the face of the last whorl there are 8 ribs in one mm at the periphery (fig 33)

MICROPHYSULA Cockerell new genus[14]

Shell clear, smooth, glassy, discoidal, with flat or very low spire of closely coiled whorls, the last embryonic whorl with microscopic spiral lines, aperture deeply lunate Type *Helix ingersolli* Bland

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[14] Many years ago Professor T D A Cockerell in a letter suggested this name for the Rocky Mountain species I did not endorse it then because the shell and teeth did not seem to me sufficiently different to separate it from the Antillean forms then placed in *Microphysa*, now in *Lacteoluna* It appears now that the genitalia are widely different

Microphysula ingersolli from the Black Range, N M , collected by the author was dissected

The integument of the foot seems to be nearly smooth The kidney, fig 34 *a*, is short, the length about twice the greatest width. Its apex is recurved towards the anterior end of the pericardium, the capacious ureter curving quite around the anterior end of the kidney The external orifice of the reproductive apparatus is below the right tentacle. The rather long penis appears to extend well beyond the insertion of the epiphallus Its very short retractor muscle is terminal and attaches to the diaphragm The epiphallus is a lanceolate, thin-walled, glandular sac, tapering to the vas deferens. The vagina is long Spermathecal duct rather large, of medium length

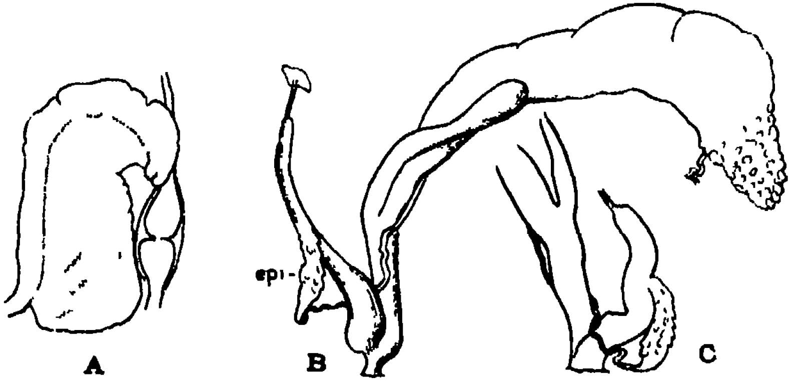

Fig. 34 —*Microphysula ingersolli* A, kidney and heart B, genitalia C, lower ducts of another individual *epi*, epiphallus.

The jaw is described by W G Binney as composed of 22 broad flat ribs It is apparently of the same type as that of *Hojeda* and *Lacteoluna* The 16 1 16 teeth, as figured by Binney, resemble those of *Thysanophora hornii*. No endocones on any of the side teeth

While this genus resembles *Thysanophora* and *Hojeda* somewhat, the differences in details of the reproductive organs, dentition and kidney seem quite enough for generic distinction Moreover, the discoidal, close-whorled, clear and glossy shell is rather characteristic and the zonal distribution is wholly diverse

HOJEDA H B Baker

Hojeda H B Baker, Occ Pap Zool Mus. Univ Mich. No. 167, 1926, p. 15
Monotype *Thysanophora vanattai* H B B

Microphysa v. Martens in Albers, Die Hel, 1860, p 82. Type by o.d. *Helix boothiana* Pfr

Small forms with milky or "corneous" shells, with very little sculpture and no periostracal outgrowths, the embryonic whorl smooth

The penis is continued in a short epiphallus with terminal vas deferens, retractor muscle and flagellum, the latter large, fusiform and conspicuously glandular Spermathecal duct of medium length Kidney triangular, about three times the length of pericardium An endocone is present on the marginal teeth[45]

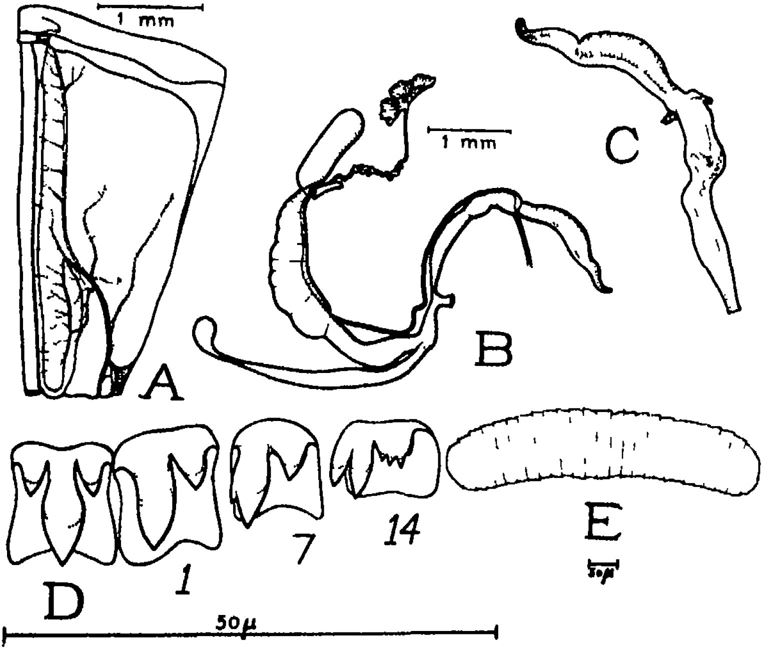

Fig 35 —*Hojeda vanattai* A, pallial complex B, genitalia. C, penis, epiphallus and flagellum slightly flattened under coverglass and viewed by transmitted light to show lumen, semidiagrammatic D, teeth E, jaw (after H B Baker)

Dr Baker informs me that three individuals he opened since publishing his account of this species each contained a single egg in the lower portion of the uterus, which was greatly distended The egg is very large relative to the size of the animal, measuring 0 94 × 0 73 mm , of ellipsoid shape, with a fairly thick and firm chalky-white shell No definite signs of embryonic development were seen on opening one, though clear and opaque-white regions were differentiated

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[45] For a full account see H B Baker's paper cited above, p 13, under the heading *Thysanophora canalis*

This group was founded for *Hojeda vanattai* (H B B) from Aruba, D W I , but as a basis for further work it may be understood to contain a considerable number of small, more or less similar, Antillean species resembling the type in having the embryonic 1½ whorls smooth, and very little sculpture on those following *H boothiana* Pfr type of the preoccupied *Microphysa*, belongs here, with other species In Florida, *H inaguensis* (Weinland) appears to belong to *Hojeda*, the shell being quite similar to the type of that genus It is a common shell of the Keys The geographic limits of the group will remain hypothetical until some of the species of the Greater Antilles and Florida are dissected

The following group is placed here with considerable doubt

AEROTROCHUS new subgenus

With the texture of *Hojeda* or *Lacteoluna*, the shape is trochoidal or pyramidal and the embryonic whorls are smooth Anatomy unknown Type *Helix subpyramidalis* C B Adams Mainly a Jamaican group, but with species in Cuba and Haiti also

Notes on species mentioned in the above list

Thysanophora conspurcatella (Morel) Text-fig 8*a*, page 77

Helix conspurcatella Morelet, Testacea Noviss II, 1851, p 7 Fischer and Crosse, Miss. Sci Mex , Moll , I, p 232, description, but not the figures.

Yucatan Merida, type loc (Morelet), Merida and Tunkas (Heilprin Exped , 1890) [46]

This species was described from around Merida, Yucatan, found under stones Subsequently a larger form was reported by Fischer and Crosse from Tenosique and Flores, Guatemala I believe that the figures given by these authors, Moll Mex , I, pl 12, figs 3–3*c*, were drawn from the Guatemalan shell, as they are larger than Merida specimens, about 4 7 mm diameter according to their fig. 3*c* Moreover, they do not agree in outline with the Merida form, as Strebel has already noticed, their specific identity is uncertain As *T conspurcatella* though often mentioned has never been described in detail, some further account of it from topotypes (Merida, Yucatan) may be useful

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[46] Other localities for *T conspurcatella* given by me in former papers were based upon specimens now regarded as different species Some of these erroneous localities were quoted in the Biologia Centrali-Americana.

The shape is characteristic The spire is very little elevated. The last whorl is somewhat flattened and slopes inward rapidly below the periphery, which is situated well above the middle of the whorl, and thus appears to be bluntly angular The shape of the last whorl gives the aperture a somewhat triangular outline in some specimens Sculpture the initial third of a whorl is smooth, then oblique strongly retractive threads arise, rather widely spaced The last whorl has unequal, partly rather strong, lines and wrinkles of growth, and well-developed retractive threads (about 08 mm apart on the last whorl in front of the aperture) Owing to the oblique intersections with the wrinkles and impressions of growth, these threads are seen to be uneven under sufficient enlargement, having in places some rather indistinct appearance of series of contiguous, low, crescentic projections[57] Toward the suture above, and at the margin of the umbilicus, the retractive lines are largely replaced by small, rounded papillæ

Height 2 mm , diam 3 5 mm , umbilicus 1 0 mm 3½ whorls
" 2 " " 3 5 " " 1 1 " 3½ "

Thysanophora impura (Pfr) Text-fig 36

A species of the state of Vera Cruz, contained in our collection from Antigua (S N Rhoads), Pacho (Strebel coll) and Vera Cruz (Heilprin Exped) I find that it extends into Yucatan also.

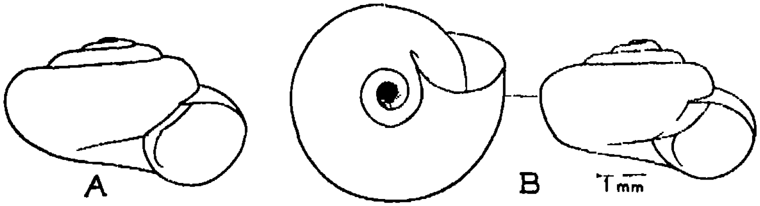

Fig 36 —*Thysanophora impura* A, Merida B, Pacho

Tekanto, Tunkas and Merida (Heilprin Exped), in the last two places associated with *T conspurcatella* (Morel)[58]

A specimen from Pacho, V C , is illustrated in fig 36 *b* It is larger than *T conspurcatella* with the spire more convex, and the outline of the last whorl different. While the periphery lies above the middle of the last whorl, the contour below it is still *convex*, not distinctly flattened as it is in *T. conspurcatella* The embryonic shell has retractive threads (text-fig 32 on page 114) On the last whorl, growth striæ are scarcely noticeable The sculpture of retractive threads is fully developed, the threads delicate, mainly even and continuous, about 07 apart on the face of the last whorl Height 2 6 mm, diam 4 2 mm, umbilicus 1 2 mm slightly more than 4 whorls

---

[57] This appearance, more or less distinct, is of course common to all Thysanophores of the typical group, but it is scarcely noticeable in those having only fine growth lines.

[58] In some former papers I confused *impura* with *conspurcatella* which is certainly distinct All authentic localities for both in our collection are given above It is somewhat surprising to find this species in the relatively humid region of Vera Cruz and also in semiarid Yucatan

Yucatan specimens from Merida, fig 36 *a*, measure Height 2 6 mm, diam 4 6 mm, umbilicus 1 3 mm A trifle over 4 whorls

Thysanophora venezuelensis (Jouss) Text-fig 37

Trichia venezuelensis Jousseaume, Mém Soc Zool France II, 1889, p 248, pl 9, figs 12, 13
? *Trichia rojasi* Jousseaume, t c p 249, pl 9, figs 9, 10 (Caracas)
Thysanophora santanaensis (Pfr), H B Baker, Occas Pap Mus Zool Univ Mich No 167, 1926, p 11 Not *Helix santanaensis* Pfeiffer [illegible]

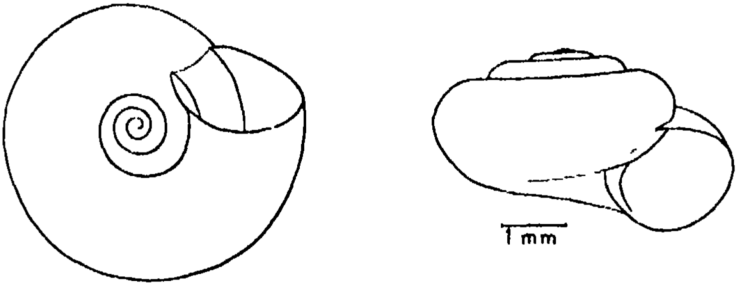

Fig 37 —*Thysanophora venezuelensis*, Cariaco

[illegible] I have not identified *H santanaensis* in Colombian or Venezuelan collections seen It appears to be known only by the works of Pfeiffer and Reeve cited below, and copied by Tryon (Man Conch II, p 165), and by Kobelt and Moellendorff (Conchyl Cab, Die Raublungenschnecken (Agnatha), 2te Abth, Streptaxidae, p 65) M Germain has figured a var *depressa* from the Cauca valley (Mém Soc Sci Nat Neuchatel V, 1914, p 256, pl 10, fig 7), but I suspect that it does not belong to Pfeiffer's species All published information on the species is contained in the following references:

Helix santannaensis Reeve, Conch. Icon. VII, pl 191, fig. 1344 (August, 1854)

Helix santanaënsis Pfeiffer, P Z S 1854, p 52 (Jan 10, 1855), Monogr IV, p 82

Scolodonta santanaensis ('Pfr.' Rve.) is one of those Cumingian species which L. Pfeiffer published in the Proceedings of the Zoological Society for 1854, not printed until the next year Meantime, finding the specimen in Cuming's collection, Reeve described and figured it, misspelling the name, which he attributed to Pfeiffer On the theory that Reeve's spelling was either a mere pen error or printer's interpolation, the deletion of the superfluous *n* is perhaps allowable

The location of "Santa Ana, New Granada," the type locality of *S santanaensis*, is somewhat doubtful See H B Baker, Occas. Pap No 156, p 19, footnote and No 167, p 11, footnote.

Venezuela Colony Tovar and Valencia (E Simon), Cariaco (F R Cocking, 1860, in coll A N S P)

Jousseaume's descriptions are extended enough, yet leave some uncertainty as to whether the surface characters of his forms are those of the *T crinita* or the *T impura* groups The figures increase one's perplexity However, since topotypes are not available, I am assuming that Jousseaume had the species represented in my fig 37, drawn from specimens taken in the neighborhood of Cariaco, a place between two and three hundred miles east of M Simon's localities, but probably in the same life zone

The description of *T impura* applies so well to the Cariaco shells that it is mainly the rather wide geographic separation which influences me to leave them as different species The threads on the last whorl are about as in *T impura* There are no hairs or other periostracal projections (such as Jousseaume mentioned), but *possibly* quite fresh examples might possess them The oblique threads of the first whorl appear to be a little more widely spaced in the Venezuela form One of the largest examples measures height 2 8 mm , diam 4 75 mm , width of umbilicus 1 4 mm

Thysanophora heilprini n sp Text-fig 38

Mexico Yautepec, State of Morelos, on the "Hill of Calvary" Type 61558 ANSP , collected by Angelo Heilprin and Frank C Baker, 1890

The shell has the depressed shape of *T impura* (Pfr), spire convex, periphery rounded, the greatest convexity in the upper half of the whorl, umbilicus broadly open, perspective, a little more than one-third the diameter of the shell The whorls are strongly

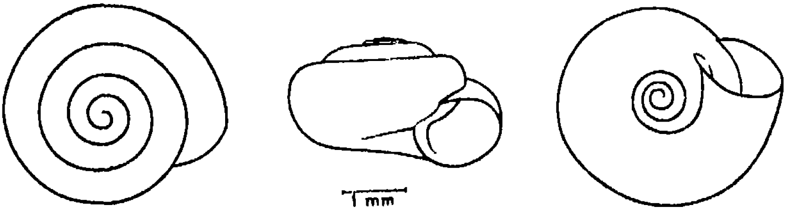

Fig 38 —*Thysanophora heilprini*

convex above, the last descending at the aperture to about the middle of the preceding Surface light brown, somewhat shining, the first whorl, after the nearly smooth initial third, with sculpture of well-spaced retractively radial threads, following nearly the direction of growth lines, and microscopically scored by close, rather superficially engraved spiral lines Post-embryonic whorls with very fine, rather irregular growth wrinkles, the last whorl with fine, irregularly wavy sparsely anastomosing wrinkles following the general direction of growth lines, in some places interrupted, forming low, fusiformly lengthened granules, in some small areas retractive threads of the *impura* pattern are seen The aperture is oblique, subcircular, not much excised at the parietal margin, the columellar margin expanded, as usual

Height 2 2, diam 3 75 mm, umbilicus 1 15 mm 4½ whorls Type

Height 2 0, diam 3 40 mm, umbilicus 1 05 mm 4¼ whorls.
" 2 0 " 3 50 " " 1 15 "

Thirty specimens were collected, all "dead," but about half are in fairly good, fresh condition One immature shell shows sparse, widely spaced hairs, of the same character as those of *T hornii* (Gabb), also seen in *T crinita* (Fulton)[60] The former, *T hornii*, differs from *T heilprini* by its smaller umbilicus *T crinita* appears to be more closely related, but in it the whorls are less strongly convex above, giving a different outline to the spire The hairs are also, it appears, more persistent than in *T heilprini*

Two lots of *T crinita* are in the collection of the Academy, both collected by J S Gibbons, one received through W G Binney many years ago, the other from Fulton Specimens measure:

Height 2 2, diam 3 4 mm
" 2 1, " 3 8 " , umbilicus 1 15 mm

The three species, *T hornii*, *T heilprini* and *T crinita*, are closely related in form, sculpture of the embryonic whorl, and in possessing sparse hairs on later whorls, generally lost in fully adult or old shells *T intonsa* (Pils) differs by its elevated form, small size, etc

The irregular sculpture of wavy wrinkles, sparsely anastomosing or interrupted, appears to be a sort of degenerate product of the pattern seen in the typical group of *Thysanophora*, but the long hairs are special to the *T hornii* group

Thysanophora jaliscoensis n. sp Text-fig 39

Mexico. Guadalajara, Jalisco. Type and many other specimens 44927 ANSP, collected by McConnell and Crawford, 1909

Similar to *T coloba* Pils in form, depressed, with strongly convex spire, rounded periphery and perspective umbilicus, its width contained about 3½ to 3¾ times in the diameter of the shell The whorls are quite convex, the last rounded beneath Light brown

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[60] *Trichodiscina crinita* Fulton, Proc Malac Soc London, XII, part V, August, 1917, p. 240 (Cartagena)

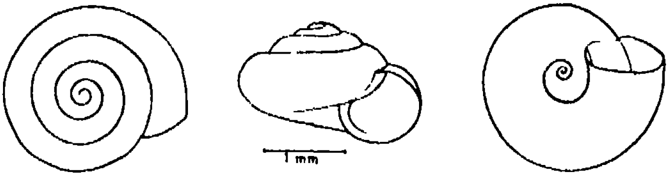

Fig 39 —*Thysanophora jaliscoensis*

Sculpture the initial ¾ whorl is smooth, relatively coarse and widely spaced spiral impressed lines then appear gradually, extending over the remainder of the embryonic shell of nearly 2 whorls The rest of the shell has very fine, close and unequal growth wrinkles and rather widely and unevenly spaced low riblets, over all run very fine, close, engraved spiral lines, giving a decussate-granulose surface The aperture is oblique, subcircular-lunate, with about one-fourth of the circle excised by the preceding whorl Lip thin, the columellar margin expanded, parietal callus thin Height 1 5, diam 2 25 mm , width of umbilicus 0 6 mm 4¼ whorls

This species is closely related to *Thysanophora coloba* Pils*, differing by the large umbilicus, contained 3 5 to 3 75 times in the total diameter In *T coloba* it is contained about 5 times in the diameter, a specimen measuring height 1 3, diam 2 mm , umbilicus 0 4 mm

Thysanophora omissa n sp Text-fig 40

Jamaica Type 5612 ANSP , from the A D Brown collection, received by him from T Bland

The shell is thin, translucent-whitish, depressed, openly umbilicate (umbilicus contained slightly more than three times in the diameter) First 1¼ whorls convex, projecting, set in places with microscopic papillæ Later whorls flattened above, with widely, unevenly spaced, weak riblets, in the direction of growth lines The last whorl is bluntly but strongly angular at the periphery, below the angle somewhat flattened, sloping inward, it descends slowly and deeply to the aperture The aperture is quite oblique transversely oval, the insertions of the simple lip remote

Height 1 5, diam 3 mm , umbilicus 0 9 mm wide 4 whorls.

I thought at first that this might be *Helix inconspicua* C B Ad., but it is smaller, with fewer whorls, though the deep descent of the aperture shows it is to be an adult individual The figure of that species given by Reeve (Conch Icon, *Helix*, fig 350) is quite unlike *T omissa*

Fig 40 —*Thysanophora omissa*.

EXPLANATION OF PLATES IX AND X

PLATE IX —Figs 1, 1a.—*Amphicyclotus olssoni*, n sp Type 47354
Figs 2, 3 —*Poteria confusa* (Sykes) Quipo 133723
Fig 4 —*Pleurodonte* (*Labyrinthus*) *sipunculata* (Forbes) Paya. 140306
Fig 5 —*Pleurodonte* (*Labyrinthus*) *chiriquensis* Pils. Island of Bocas del Toro 140303
Fig 6 —*Pleurodonte* (*Labyrinthus*) *uncigera* (Petit) Rio Puerco 140305
All figures natural size.
PLATE X —Fig 1 —*Euglandina dactylus* (Brod) Near Lagarto 47352.
Fig 2 —Spire of same × 3
Figs 3, 4.—*Euglandina cumingi* (Beck) Panama 24780, 74037
Figs 5, 6, 7 —*Drymaeus expansus balboa*, n subsp Type and paratypes.
Fig. 8.—*Euglandina gigantea* n sp Sculpture from front of last whorl of type × 2.8.
Fig 9 —*Euglandina sowerbyana* (Pfr) Sculpture from front of last whorl × 2.8

COSTA RICAN LAND SHELLS COLLECTED BY A A OLSSON

BY H A PILSBRY

On his return from a geologic trip to Costa Rica in 1921, Mr A A Olsson gave me a small but interesting series of land shells They are all from the Atlantic coastal country, from stations which do not exceed 100 feet in elevation

References to descriptions are omitted, as they can be found in von Martens' volume on Mollusca in the Biologia Centrali-Americana, or in Crosse and Fischer's Mollusques of the Mission Scientifique au Mexique

HELICINIDÆ

HELICINA FUNCKI Pfr Talamanca Valley

HELICINA (OLIGYRA) BEATRIX Angas La Emilia (J A G Rehn)

LUCIDELLA LIRATA (Pfr) Cahuita

HELICIDÆ

LEPTARIONTA ZHORQUINENSIS (Angas) Monkey Point, on the beach

CAMÆNIDÆ

PLEURODONTE (LABYRINTHUS) ÆSOPUS (Angas) Cahuita, rather large, high examples, 28 to 29 5 mm in diameter, Talamanca valley a less elevated form

BULIMULIDÆ

BULIMULUS CORNEUS (Sowb) Cahuita

DRYMÆUS ZHORQUINENSIS (Angas) Rio Cocles.

DRYMÆUS JOSEPHUS (Angas) Cahuita, Banana River, 100 ft elevation, Talamanca Valley

DRYMAEUS INUSITATUS Fulton Banana River, on the "cokito" palm

OXYSTYLA PRINCEPS (Sowerby) Talamanca Valley

ACHATINIDÆ

OPEAS BECKIANUM (Pfr) Cahuita

OPEAS MICRA (Orb) Cahuita

SUBULINA OCTONA (Brug) Cahuita

GLANDINIDÆ

Euglandina sowerbyana (Pfr) Plate XI, figs. 3, 4 plate X, fig 9

This species was described from Totontepec in southwestern Oaxaca It is a large form, 90 to over 100 mm long, with coarse, textile sculpture Pfeiffer[1] says closely plicate longitudinally, decussate-granulate by spiral, unequally spaced striae apex acute Aperture five-ninths the length Length 88, diam 38 mm The type specimen has never been figured, but the description applies well to the form of Vera Cruz Province which Strebel[2] discussed and figured as "*Gl sowerbyana* Form A" The apex of this form is very small for so large a shell The first half whorl rises distinctly above the second whorl as in Pl XI, fig 3 This typical form of *E sowerbyana* is before me from eastern Mexico, collected by Berendt (Pl XI, figs 3, 4), and from Guatemala, collector not known One from Vera Cruz Province measures, length 105, diam 43, aperture 58 mm , thus a trifle narrower than Pfeiffer's type, but having the exact proportion of aperture to length

Euglandina gigantea n sp Plate XI, figs. 5, 6, 7, plate X, fig 8

Salinas Bay, in southwestern Costa Rica, A Alfaro, Costa Rica, without nearer indication of locality, W M Gabb

The Costa Rican form of the *E sowerbyana* type differs from that discussed above by its constantly *blunter apex*, the first whorl revolving nearly in a plane, though somewhat convex above, as in Pl X, fig 6 Generally the spiral sculpture of the later whorls is *closer* than in *sowerbyana*, cutting the axial striæ into shorter grains, as in Pl IX, fig 8 The sutural denticulation is weaker than in typical *E sowerbyana* As in most of the genus, the length of the spire varies within wide limits

Length 104 mm , diam 45 mm , aperture 61 mm 7½ whorls
Type
Length 94 mm , diam 44 mm , aperture 58 mm

This form was described and figured as "*Gl sowerbyana Form B*" by Strebel (loc cit p 16, Pl 5A, figs 10*o*, 10*m*, 10*n*) from San José, Costa Rica, and from Chiriqui (fig 10*h*) According to von Martens (Biologia Centrali-Americana, Moll., p 610), quoting Biolley, it "chiefly inhabits the 'tierra caliente,' . all the specimens from the elevated central plain are of smaller size"

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[1] Proc. Zool Soc London 1846, p 32

[2] Beitrag Mex. Land- und Süsswasser-Conch , II Theil, 1875, p 15.

Gabb collected also two slender specimens which were listed by Angas (P. Z S 1879, p 479) as *Glandina lignaria* Reeve The apex is as described above, but the sculpture is weaker throughout One measures length 88 mm , diam 36 5 mm , aperture 52 mm Gabb's description of the living animal was quoted by Angas, his drawing of it accompanies a specimen in our collection (No 24768) All of these shells were said to have been taken by Gabb "only in high country, as high as 6000 feet, Costa Rica", but Gabb's off-hand and general statements as to localities are likely to be unreliable

Euglandina gigantea gabbi n subsp Plate XI, figs 1, 2

A miniature form of the preceding species was also taken by Gabb, and is evidently what Angas[3] identified as "*Glandina aurata?* Morelet"

It is thinner than *E gigantea*, with weaker, finer sculpture of the same general nature, the apex also is similar The color is antimony yellow with many ochraceous-tawny streaks. Length 56 3 mm., diam 25.7 mm , aperture 36 mm , 5¾ whorls

No definite locality in Costa Rica was given by Gabb, but it is probably identical with the small form from the elevated central plain of Costa Rica, mentioned by Biolley, quoted by von Martens, Biologia Centrali-Americana, Moll , p 610 Type 24771 ANSP.

EUGLANDINA BROCTONTOMLINI Pils Cahuita, Talamanca Valley (Olsson) Vesta farm, Estrella Valley (J A G Rehn) Described on page 97

SCOLODONTIDÆ

DREPANOSTOMELLA STOLLI (von Martens) Cahuita

OCCULTATOR new genus

The shell is small, discoidal, imperforate, smoothish, of few deeply embracing whorls, the spire exposed, flattened

The reference of this genus to the family Scolodontidæ is provisional The single species known differs from the genus *Guestieria* Crosse by the exposed spire, occupying about half the diameter of the shell Seen from above it has some resemblance to *Drepanostomella*, but in that genus the umbilicus is open and the lip strongly retracted at its upper insertion

Occultator olssoni n sp Text-fig 1

Cahuita. Type 104675 ANSP , collected by A A Olsson

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[3] Proc. Zool Soc Lond. 1879, p 480, pl 40, fig 6

The shell is strongly depressed with flat spire and rounded periphery, imperforate, smoothish, under a high power showing a dense microscopic granulation. The apex projects very slightly. The spire is narrow, not occupying quite half of the total diameter, of 3½ very slightly convex whorls, the last whorl embracing a large part of the penult, impressed at the axis The aperture is deeply lunate, with only slight obliquity The peristome is simple, the baso-columellar margin straightened and noticeably thickened

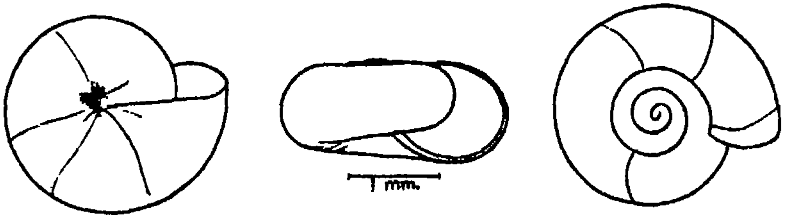

Fig. 1 *Occultator olssoni.*

Height 1.15 mm , diam 2 5 mm

The single example taken is bleached white.

ZONITIDÆ

Pseudohyalina puncticipitis n sp Text-fig 2

Chama, Guatemala Type and 4 paratypes No 45656 ANSP., collected by A. A. Hinkley, 1917

The minute shell is depressed, openly umbilicate, the umbilicus contained slightly more than 3 times in the diameter, corneous, translucent, thin The first whorl has sculpture of spiral impressed lines; radial striæ then appear, cut by the spirals into a regular tesselation of rounded granules; (this sculpture is extremely superficial, and not fully seen except in immature shells). On later whorls the radiating striæ continue but the spiral lines weaken, though still faintly visible on the last whorl. Here the striæ stand about 0.017 to 0 02 mm apart, locally quite regularly developed, but in places nearly effaced. The whorls are convex

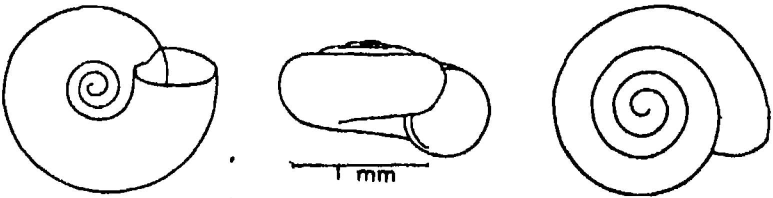

Fig. 2. *Pseudohyalina puncticipitis*

above, at the periphery and the base Suture deeply impressed The aperture is slightly oblique, rotund-lunate Peristome thin

Height 0 8 mm , diam 1 55 mm , about 3⅞ whorls

The sculpture, while very minute, is characteristic, the wide umbilicus and small size it has in common with *P nummus* (Vanatta), of Texas

Zonitoides multivolvis n sp Text-fig 3

Cahuita, Costa Rica, Type 140311 ANSP , collected by A A Olsson.

The shell is umbilicate, the umbilicus conic, contained 3¼ times in the diameter, gray-whitish (dead), with decidedly convex spire, rounded periphery and base The whorls are closely coiled, convex, with very weak and rather unequal wrinkles of growth, which retract slightly as they approach the suture and weaken at and below the periphery The aperture is deeply lunate, the lip simple, its insertions remote, the upper end slightly retracted

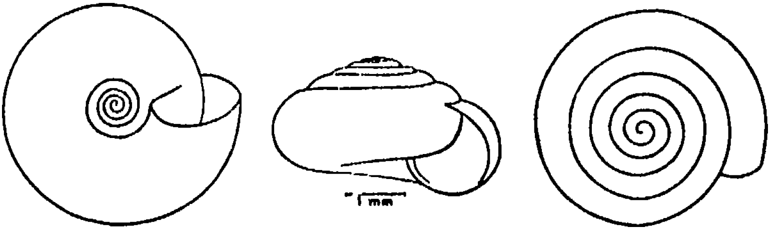

Fig 3 —*Zonitoides multivolvis.*

Height 2 3 mm , diam 4 mm , 5½ whorls

This species is distinguishable from others of the region by the close coil of the whorls In this respect it resembles *Z pentagyra* Pils , from Tampico, but that is a decidedly smaller species, with differently shaped aperture The generic position remains doubtful. There is no very definite conchological distinction between *Zonitoides* and *Scolodonta,* the latter includes a number of species having closely convoluted whorls, and probably that is where the present form belongs *Scolodonta* has not hitherto been recognized so far north, so that pending an examination of the anatomy, the two closely coiled species are left in *Zonitoides.*

Zonitoides arboreus (Say) Banana River.

ENDODONTIDÆ

Radiodiscus millecostatus costaricanus n subsp Fig 4 b

Banana River (Olsson) Type and paratypes 140676 ANSP

Smaller than Arizona specimens of *R millecostatus*,[4] height 1mm, diam 1 8 mm, with 3½ whorls, sculptured about as in that species; there are about 15 riblets in 1 mm at the periphery of the last whorl, about 4 striæ in each intercostal interval The aperture is wider than in *millecostatus* Six apparently adult and several young specimens No 140676 ANSP.

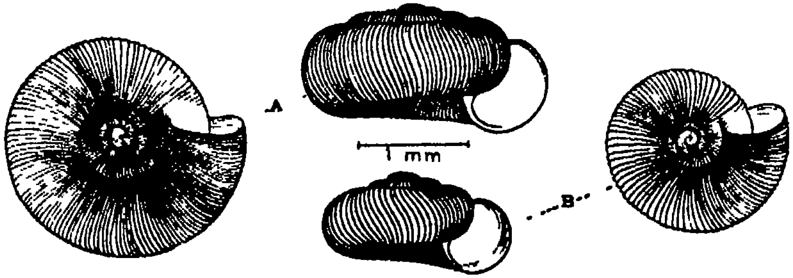

Fig. 4 A, *Radiodiscus millecostatus* B, *R m. costaricanus*

Rotadiscus and Mexicodiscus

In connection with the preceding form, various small patuloid snails of Mexico and Central America were examined, some notes on which may be given here

Helix hermanni Pfr has been referred to "*Patula*" by authors who have mentioned it, but its characters do not agree with that series. The general appearance is more that of *Radiodiscus*, but the embryonic whorls are without spiral sculpture It may be made the type of *Rotadiscus*, n. gen, with the following characters: Depressed, discoidal, with whorls of small caliber and broadly open umbilicus, embryonic 1½ whorls very densely microscopically pitted, the rest radially costulate, closely coiled

The northeast Mexican *Gonyodiscus victorianus* (Pils.)[5] has the general figure of the Holarctic genus *Gonyodiscus* Fitzinger, and pending examination of the soft anatomy, it should be referred, I believe, to that genus However, it differs in details of the embryonic whorl from any species I have examined, and I propose the subgenus *Mexicodiscus* for it, characterized by having the initial ¾ to 1 whorl almost smooth, but in the most perfect examples showing excessively minute and faint spiral lines, the change to neanic sculpture not abrupt, the first riblets being low and short Riblets of the later whorls are strongly retractive, as in *Gonyodiscus*, with which the general shape also agrees I do not know of any other species of this particular group

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[4] The type of *R millecostatus* was not fully adult Subsequent to its description the species was taken by hundreds, and found commonly to reach a size of 1 2 mm height, 2 25 mm diameter, with 4¼ whorls. Text-fig. 4*a* represents an adult example from Miller canyon, Huachuca Mts., Arizona.

[5] *Pyramidula victoriana* Pils., Proc A N S. Phila., LV, 1904, p. 769, pl. 49, figs. 1-1*b* Victoria, Tamaulipas.

EXPLANATION OF PLATE XI

Figs. 1, 2 —***Euglandina gigantea gabbi***, new subsp Type, natural size, and enlarged detail of surface × 3

Figs. 3, 4 —***Euglandina sowerbyana*** (Pfr) Eastern Mexico (Dr Berendt) The apex × 2 6, and the shell, natural size No 24767

Fig 5 —***Euglandina gigantea*** n sp Costa Rica (W M Gabb) No 24769, natural size

Figs. 6, 7 —***Euglandina gigantea*** n sp Salinas Bay, Costa Rica Type, natural size, and apical whorls × 2 6 No 67142

THE BLATTIDAE OF FRENCH GUIANA

BY MORGAN HEBARD

In 1922 Dr Lucien Chopard submitted for study a collection of Blattidae received, through E Le Moult, from French Guiana. The author is allowed to retain the types and uniques, as well as a representative series of the other species The balance is presented to the Paris Museum by Dr Chopard, to which the author is to add an adequate exchange of Orthoptera in return for the types and uniques.

As there are now, awaiting study in the Philadelphia collections, large series of the Blattidae from Trinidad, Venezuela, British Guiana and the Amazon, we are pleased to be able to report also on so fine a series from French Guiana The six hundred and eighty-four specimens before us represent one hundred and eighteen species and forty-nine genera, of which fifty-three species and six genera are described as new. We have added the records published by us on the Blattidae of this region in 1921,[1] and of the few species previously recorded from French Guiana but not represented in the present material, in order to complete the data we have assembled for this fauna

ECTOBIINAE

Lissoblatta orientis new species. Plate XII, figure 1

This species is closely related to the Central American *L fulgida* (Saussure) and resembles that insect in size and coloration It is best separated by the male genitalia, in which the sinistral style is about two-thirds as long as the dextral, instead of being only about one-third as long, while the intervening area is occupied by an obliquely placed, roughly rectangular plate, with dextral margin minutely quadridentate, instead of having a single heavier decurved spine sinistrad and the remaining portion of this area feebly triangularly produced.

The female sex of these species is apparently indistinguishable

Type: ♂; St Jean du Maroni, French Guiana. June. [Hebard Collection, Type no 987.]

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[1] Proc. Acad. Nat. Sci. Phila., 1921, pp 193 to 304.

General structure as given in generic description[2] Size as large and form as robust as in *fulgida*, large and robust for the genus Supra-anal plate triangular, half as long as wide, exactly as in *L flabellata* (Saussure and Zehntner). Styles asymmetrical, though not nearly as much so as in that species Sinistral style triangular with apex very broadly rounded, slightly longer than its basal width, situated on the dorsal surface of the subgenital plate at its margin and directed dorso-mesad (though apparently somewhat movable). The intervening margin between the styles is very feebly triangularly produced and is surmounted by an obliquely set, roughly rectangular plate, the dextral (apical) margin of which plate is armed with four minute curved spines Dextral style about a third longer than sinistral though narrower at its base, shaped like a straight finger directed dorso-mesad.

Allotype ♀, same data as type, except taken in December. [Hebard Collection.]

In size and form agreeing closely with male and apparently indistinguishable from this sex of *fulgida* Ootheca also as in that species.[3]

General coloration deep shining chestnut, the pronotal margins and tegmina paler when spread, burnt sienna Ultimate joint of maxillary palpus and apex of preceding joint blackish brown.

One paratype is slightly paler, while that from Bartica, British Guiana, is distinctly paler, approaching burnt sienna in general coloration.

The measurements of the described pair are length of body ♂ 6 8, ♀ 7, length of pronotum ♂ 1 8, ♀ 1.8, width of pronotum ♂ 2.8, ♀ 2.8, length of tegmen ♂ 6 9, ♀ 7, width of tegmen ♂ 2 9, ♀ 2.9 mm.

In addition to this pair there are before us three paratypes, one male bearing the same data, one female labelled "Cayenne" and one female from Bartica, British Guiana, taken March 26, 1912, by H. S. Parish and belonging to the Academy of Natural Sciences of Philadelphia.

Lissoblatta distincta new species. Plate XIV, figures 11 and 12.

This insect represents a very distinctive group, having the discoidal sectors of the tegmina as oblique and more regular than in the Central American *L. fulgida* (Saussure), but the size smaller, the form much more slender and the color very dark. These latter features give it a general, though purely superficial, resemblance to species of the Lateralis Group of *Anaplecta* Burmeister, though it is distinctly larger than any of them

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[2] Mem. Amer Ent Soc , No. 4, p. 10, (1919)

[3] Described, Mem. Amer Ent Soc , No 4, p 12, (1919)

The tarsal claws are not as strongly asymmetrical as in the other known species of *Lissoblatta* Though the slender form and narrow tegmina disagree with our original concept of this genus, all the other characters shown by *distincta* conform and we do not believe that generic separation would be advisable

Type ♂, La Forestière, upper Maroni River, French Guiana July [Hebard Collection, Type no 1013]

Size small and form slender for the genus Head, pronotum, wings and their venation and limb spination as characteristic of the genus[4] Tegmina comparatively narrow and elongate, apex sharply rounded, discoidal sectors (seven) unbranched and very regular, fully as oblique as the costal veins Wings very similar to those of *fulgida*, but distinctly narrower Sixth abdominal tergite with a median node, heavily supplied with microscopic agglutinated hairs, with a depression on each side, this specialization not as prominent as in *fulgida* Supra-anal plate produced between cerci with lateral margins concave-convergent to the rounded apex, the concavity of the lateral margins greater and the apex narrower and more produced than in *fulgida* Subgenital plate very small, large, socketed, convergent styles present, the sinistral about two-thirds as long as the dextral and only slightly over half as heavy The space between these simple, finger-like processes is filled by a narrow production of the median portion of the plate Fourth tarsal joint with very small ventral surface occupied by a pulvillus Tarsal claws simple, moderately asymmetrical, the shorter, however, reaching slightly beyond the arolium

General coloration blackish prouts brown Tegmina translucent prouts brown Lateral margins of pronotum and marginal field of tegmina transparent ochraceous buff, a fleck of the same near apex of anal field of sinistral tegmen Face paling slightly, with a tawny tinge

The measurements of the unique male type are; length of body 6 4, length of pronotum 1 7, width of pronotum 2 3, length of tegmen 1 8 mm.

Lissoblatta stylata new species. Plate XII figure 2.

Like *L orientis* here described, this species is closely related to a Central American insect, in the present case *L flabellata* (Saussure and Zehntner). These species are well separated from those of the Fulgida Group by being smaller and less robust, with tegminal discoidal sectors less oblique

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[4] Described, Mem. Amer Ent Soc , No 4, p 10, (1919)

We find that *stylata* can be separated from *flabellata* only by the male styles, the dextral being highly specialized in the present insect.

Though but two specimens of *stylata* are before us, they show that decided variation in tegminal coloration occurs, probably much as in *flabellata*.[5]

Type ♂, St. Jean du Maroni, French Guiana. [Hebard Collection, Type no. 988.]

General structure as given in the generic description,[6] except as noted above. Styles asymmetrical. Sinistral style represented by a small straight finger (larger and showing weak curvature in *flabellata*). The intervening margin of the subgenital plate between the styles is produced triangularly, with apex acute (flat to the inset sinistral style in *flabellata*). Dextral style represented by a somewhat curved finger, lying along the dextral margin of the median production and consequently directed dorso-mesad, longer and nearly twice as large as the sinistral style, its dorsal surface armed with a heavy, erect spine, which points toward the supra-anal plate (represented by a simple, straight finger, only slightly larger and longer than the sinistral style in *flabellata*).

General coloration sayal brown, the pronotal disk bister. Tegmina uniform in type, in paratype suffused at shoulders and mesad with broad, dark, nebulous bands. Precisely similar tegminal color variation occurs in *flabellata*, though such is unusual in the Blattidae.

The measurements of the male type are, length of body 6.1, length of pronotum 1.7, width of pronotum 2.4, length of tegmen 6.2, width of tegmen 2.3 mm.

A paratypic male, bearing the same data, is before us.

Anaplecta minutissima (DeGeer)

1773. *Blatta minutissima* DeGeer, Mém. l'Hist. Ins., III, p. 542, pl. 44, figs. 13 and 14. [Surinam.]

We fully agree with Rehn[7] in his statement that DeGeer's *minutissima* was based on material of the genus *Anaplecta* and that the specimen of *Holocompsa*, believed to be the type of that species and so described by Shelford, can certainly not be recognized as the type of *minutissima*.

St. Jean du Maroni, French Guiana, 1 ♀.

Nouveau Chantier, French Guiana, 1 ♀.

La Forestière, upper Maroni River, French Guiana, 1 ♀.

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[5] See, Mem. Amer. Ent. Soc., No. 4, p. 13, (1919).

[6] Mem. Amer. Ent. Soc., No. 4, p. 10, (1919).

[7] Proc. Acad. Nat. Sci. Phila., 1918, p. 145, footnote 3, (1918).

The length from occiput to apex of tegmina, in these females, is 4 7 to 4 9 mm

Anaplecta subsignata new species. Plate XII, figures 3 and 4

This species is evidently nearest the Central American *A asema* Hebard It is similarly a medium sized and moderately slender species of a pale ochraceous general coloration, with prominent buff ocellar spots It differs in having a weak suffusion of brown on each side of the pronotum, at its caudal margin above the insertion of the tegmina, and another on each tegmen, beyond the apex of the anal field and filling the area between the discoidal and median veins

These suffusions are variable in intensity and extent and in intensive individuals those of the tegmina are continued more narrowly along the discoidal vein to its base The head is suffused with darker brown particularly toward the buff ocellar areas, but shows no distinct transverse band between them

Type: ♂; Nouveau Chantier, French Guiana October [Hebard Collection, Type no 989]

Size small and form moderately slender for the genus Head distinctly longer than broad, interocellar area forming with margins of ocellar areas a decidedly projecting but rounded ridge above each antennal socket, ocellar spots distinct Pronotum rectangulate-ovate, narrowing very slightly more cephalad than caudad; surface feebly convex, showing distinct latero-caudal flattening of disk Tegmina narrow, costal margin weakly convex to the bluntly rounded apex, costal veins numerous (eleven); five longitudinal discoidal sectors apparent Supra-anal plate highly specialized, about twice as wide as long, free margin almost evenly convex, the ventral surface produced in a large projection beneath the meso-distal portion, dorsal surface deeply impressed meso-proximad, this area bordered laterad by broadly convex ridges, which converge caudad, the depression containing a large tuft of agglutinated hairs, which are directed dorso-cephalad. Subgenital plate with dextral margin irregularly convex and bearing a very small, simple style, sinistral margin straight, oblique, then broadly concave, a small, simple style situated at the base of this concavity and extending to its apex, where the margin of the plate forms a minutely bi-nodose angle, the apex of the style resting between these nodes Tarsal claws symmetrical, arolia minute

Allotype. ♀, same data as type. [Hebard Collection.]

Agrees closely with male in all ambisexual features. Subgenital plate of the decided valvular type characteristic of *Anaplecta.*

General coloration ochraceous-buff, marked as noted above.

The measurements of the described pair are as follows. length of body ♂ 5 4, ♀ 5 8, length of pronotum ♂ 1.4, ♀ 1.6; width of pronotum ♂ 1 9, ♀ 2, length of tegmen ♂ 5 8, ♀ 5 8, width of tegmen ♂ 1 7, ♀ 1 8 mm

Specimens Examined 6, 3 males and 3 females

St Jean du Maroni, French Guiana, August 1, 1 ♂, *paratype*

St Laurent du Maroni, French Guiana, May and December, 1 ♂, 1 ♀, *paratypes*

Nouveau Chantier, French Guiana, January and October, 1 ♂, 2 ♀, *type, allotype* and *paratype*

Anaplecta insignis new species. Plate XII, figure 5.

This handsome little insect is distinctive in being dorsad solidly blackish brown except the transparent lateral margins of the pronotum, costal margins of the tegmina and a broad area on each tegmen which borders the anal vein and runs from near the discoidal vein almost to the sutural margin

The tegminal color pattern agrees closely with that of *A analisignata* Rehn, described from Manaos, Brazil, though the contrasts are stronger and the pale meso-proximal areas are broader in the present insect. We find *insignis* to be further separable from that species by the pronotal disk, which is solidly colored instead of bivittate and the tegminal veins, which are raised distad This latter feature is more pronounced in the male than in the females of *insignis* In spite of these differences *analisignata*[8] is clearly nearest in relationship of the known species

Type ♀; Nouveau Chantier, French Guiana. August [Hebard Collection, Type no 990]

Size small for the genus, form rather broadly elliptical Agrees with the description of *A. subsignata* on page 139, except as follows. Ridge above ocellar areas less decided, ocellar spots distinct but not as prominent Latero-caudal flattening of pronotal disk weak Tegminal costal veins numerous (eleven distinguishable), longitudinal discoidal sectors few (four distinct) Subgenital plate of the decided valvular type usual in the genus.

Allotype: ♂; Bartica, British Guiana. March 31, 1913. (H. S Parish) [Acad Nat Sci Phila.]

Size smaller and form distinctly more slender than female, agreeing in all other ambisexual characters Supra-anal plate highly specialized; free margin convex, with the convexity most decided mesad, dorsal surface impressed proximo-mesad, this impression containing a large tuft of agglutinated hairs directed cephalad and terminated caudad by a weak, convex ridge. Subgenital plate with lateral margins straight and feebly convergent, distal margin very feebly oblique and very weakly convex, then broadly concave at base of sinistral style.[9]

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[8] Though lacking the abdomen, the type of *analisignata* was described as a female From comparison with the sexes of *insignis*, we believe that type to be a male

Head mummy brown, darkest on occiput. Antennae, palpi and limbs buffy. Ventral surface buffy, washed with mummy brown. Pronotum solidly blackish mummy brown, except lateral portions which are transparent and show very faintly a buffy tinge. Tegmina blackish mummy brown, with costal margin and the post-anal areas, described above, transparent and showing very feebly a buffy tinge. Wings vitreous, iridescent, faintly tinged with brown only in area of costal veins and in appendicular field.

The measurements of the described pair are as follows: length of body ♂ 5, ♀ 5.2, length of pronotum ♂ 1.3, ♀ 1.4, width of pronotum ♂ 1.7, ♀ 1.8, length of tegmen ♂ 4.8, ♀ 4.9, width of tegmen ♂ 1.4, ♀ 1.7 mm.

Two paratypic females, one bearing the same data as the type, the other from La Forestière, French Guiana, taken in July, have also been studied.

Anaplecta suffusa new species. Plate XII, figures 6 and 7

This insect, a member of the Bivittata Group, has the pronotum strikingly marked with two longitudinal dark bars, which fuse caudad. The tegmina are suffused with dark brown, with only the costal margin pale. The darker portions of the tegmina are of uniform shade, this aiding in distinguishing the species from its nearest ally, the Panamanian *A. hemiscotia* Hebard.

In size it agrees with that species and the western Ecuadorean *A. falcifer* Hebard, being larger than the Amazonian *A. bivittata* Brunner and *A. analisignata* Rehn. The male sinistral style is much less specialized than in its nearest allies.

Type: ♂; St Laurent du Maroni, French Guiana. July. [Hebard Collection, Type no. 991.]

Agrees with the description of *A. subsignata* on page 139, except as follows. Size medium for genus; form elongate elliptical, as in *hemiscotia*. Tegmina elongate, costal veins numerous (ten), the marginal field with numerous spurious veinlets resembling the costal veins. Subgenital plate with margin sinuous, produced slightly more sinistrad than dextrad, styles very small, simple, elongate conical, the sinistral slightly longer than the dextral.

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[9] This specimen is in too poor condition to describe the contour of the styles.

Allotype ♀, Bartica, British Guiana March 6, 1913. (H S. Parish) [Acad Nat Sci. Phila.]

This sex agrees closely with the male in all ambisexual characters. The subgenital plate is of the decided valvular type characteristic of *Anaplecta.*

Head ochraceous tawny, the occiput prouts brown with a median and, on each side, a juxta-ocular fleck of ochraceous tawny The female allotype, apparently discolored, has the head more generally suffused, the occiput not showing paler markings Ventral surface and limbs buffy Pronotum with lateral portions transparent and very faintly tinged with yellowish brown, ornamented with a pair of heavy longitudinal bands of blackish chestnut brown, which widen irregularly caudad, almost fuse meso-cephalad and are narrowly fused along the caudal margin These bands inclose an area of antimony yellow, which is roughly shaped like an elongate hour glass Tegmina translucent chestnut brown, paling very slightly toward the costal margin, but with marginal field almost colorless and transparent. Wings (apparently) suffused.

The measurements of this pair are as follows. length of body ♂ 6, ♀ 7 1,[10] length of pronotum ♂ 1 7, ♀ 1 7, width of pronotum ♂ 2.1, ♀ 2 2; length of tegmen ♂ 6 2, ♀ 6 2, width of tegmen ♂ 2, ♀ 2 mm

Anaplecta pluto new species. Plate XII, figure 8.

This insect apparently has no close affinities The tegmina show the veins even more raised than in *A insignis* here described, a feature not shared by any of the Central American species known to us The uniform dark coloration suggests the Panamanian *A. sordida* Hebard, but that insect is much smaller, with proportionately longer tegmina which are smooth, and has the lateral lobes of the pronotum and marginal field of the tegmina less suffused. Neither are these species to be confused with *A lateralis* Burmeister and its allies, which belong to a very distinct group

Type ♀, Nouveau Chantier, French Guiana June [Hebard Collection, Type no 992]

Agrees with the description of *A subsignata* on page 139, except as follows Size medium for the genus, form rather broadly elliptical. Head with interocular portion of occiput more convex, showing no flattening, ridge above antennal sockets well defined but narrower Pronotum with surface evenly convex, latero-caudal sulci obsolete. Tegmina showing some reduction, probably scarcely reaching apex of abdomen when in normal position,[11] rather broad, narrowing distad to the bluntly rounded apex, costal veins regular and numerous (twelve), (five) discoidal sectors longitudinal, but not parallel to the sutural margin, which is more than usually oblique beyond the anal field, in addition there is a spurious longitudinal vein between the discoidal and median veins, all veins distinctly raised. Wings (apparently[12]) with a considerable appendicular field. Subgenital plate of the valvular type characteristic of *Anaplecta*.

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[10] *Body crushed, in normal position probably at least one millimeter less.*

[11] The abdomen is flattened out in this specimen

General coloration shining dark chestnut brown, the pronotal lateral lobes and marginal fields of the tegmina transparent, but strongly tinged with that color. Ventral surface of abdomen mesad slightly paler.

This type, a female, measures as follows, length of body 7,[13] length of pronotum 1.4, width of pronotum 2.3, length of tegmen 5.1, width of tegmen 1.9 mm.

The type is bearing an ootheca, approximately 2 mm. in length and somewhat longer than deep. This ootheca has the dorsal flattened valvular portion occupying a third the depth, the remainder convex, divided into four vertical sections by fine sulci and showing over seven distinct but fine longitudinal carinae.

Anaplecta poecila new species. Plate XII, figure 9

This species is nearest *A. maronensis* Hebard. It may be distinguished by the immaculate pronotal disk and the more strikingly colored tegmina which show two broad, transverse suffusions. These species are apparently widely separated from those previously treated, and may be recognized by their decided Plectopteroid facies.

Type: ♀; La Forestière, upper Maroni River, French Guiana July. [Hebard Collection, Type no. 993.]

Size very small, though not as small as *maronensis;* form elliptical, broader than in that species. Head slightly longer than broad. Vertex evenly convex, without distinct ridges over the antennal sockets, ocellar spots subobsolete. Pronotum apparently oval, but slightly more narrowed cephalad than caudad, cephalic margin convex, caudal margin very feebly sinuous, surface weakly convex, with no trace of latero-caudal sulci. Tegmina extending a brief distance beyond apex of abdomen, moderately narrow, wider than in *maronensis;* costal margin very feebly convex to near the apex, where it rounds more sharply to meet the almost straight sutural margin, apex sharply rounded; costal veins inconspicuous, not numerous (eight to nine), with a few spurious intermediate veins distad; discoidal sectors two in number. Wings with appendicular field approximately four-fifths as long as remaining portion[14] Subgenital plate of the decided valvular type characteristic of *Anaplecta*.

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[12] This unique specimen is in too poor condition to justify an attempt to relax and spread a wing.

[13] Approximated for natural position.

Head blackish prouts brown, antennae prouts brown Ventral surface ochraceous tawny, the abdomen tinged with prouts brown laterad Limbs ochraceous buff with a faint tawny tinge. Pronotum with disk bright ochraceous tawny, the other portions transparent and weakly tinged with ochraceous tawny. Tegmina with marginal field like pronotal lateral margins, remainder of proximal portion to apex of anal field blackish brown, beyond rich ochraceous-tawny with a strong orange tinge, deepening in distal portion. Wings with appendicular field darkened

This female type measures, length of body 4 8, length of pronotum 1 2, width of pronotum 1 7,[15] length of tegmina 4.1, width of tegmina 1 7 mm

We have before us a paratypic female, taken between Chenapowu and Saveritik, British Guiana, August 21, 1911, by H. C Crampton, belonging to the American Museum of Natural History. This specimen is less intensive in coloration, the proximal dark suffusion of the tegmina does not extend to the marginal field laterad and distal darkening is even more weakly suggested

Anaplecta maronensis Hebard.

No additional material of this species, described from La Forestière, French Guiana, has been received.

Anaplecta pulchella Rehn

1906. *Anaplecta pulchella* Rehn, Proc Acad. Nat Sci Phila., 1906, p. 262. [♀, Demerara, British Guiana.]

Les Hattes, lower Maroni River, French Guiana, July, 1 ♀.

Nouveau Chantier, French Guiana, March, 1 ♀.

We have also recorded this large species from Albina, Maroni River, Dutch Guiana[16]

MARACA[17] new genus

This genus is erected to include the single minute species, *M fossata* here described. Nearest relationship to *Anaplecta* Burmeister is found, and particularly to the species *domestica* Saussure and Zehntner, *alaris* Saussure and Zehntner, *cabimae* Hebard, *saussurei* Hebard, *maronensis* Hebard and *poecila* here described

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[14] Probably with very similar venation to that of *maronensis*, described Proc. Acad Nat Sci Phila., 1921, p 194, (1921)

[15] The pronotal dimensions, originally given by us for *maronensis*, are incorrect, all being probably about one millimeter too great.

[16] The type (Hebard Collection Type no. 509) and five topotypic females, taken with it, are now before us.

[17] A rattle or devil disturber, used by the Indians of French Guiana.

The antennal annulation and both structure and outline of the pronotum are, however, very different, suggesting the Corydid *Oulopteryx meliponarum* Hebard

The generic features of importance are Size very small, form moderately robust Pronotum almost oval, coriaceous throughout, disk with broad, irregular but symmetrical shallow impressions Tegmina and wings fully developed, the former with veins all heavy and raised, giving a ribbed appearance,[18] discoidal sectors longitudinal Wings with a large appendicular field, which folds and is reflexed as in *Anaplecta*, costal veins not clubbed [19] Female subgenital plate valvular Ventro-cephalic margin of cephalic femora with a few elongate hairs, succeeded by a closely set row of very short, microscopic spinulae,[20] a few spines on the other ventral femoral margins Pulvilli and arolia absent Tarsal claws simple, exceedingly fine, symmetrical

Maraca fossata new species Plate XIV, figure 13

The structure of this minute, solidly blackish brown cockroach is very distinctive, the ribbed tegmina being particularly unusual

Type ♀, La Forestière, upper Maroni River, French Guiana July [Hebard Collection, Type no 1014]

In addition to the characters given in the generic description, the following are noteworthy Size much the same as in *Anaplecta poecila* here described, form slightly broader Head distinctly longer than broad, interocellar area forming with margins of ocellar areas a distinct projecting but rounded ridge over each antennal socket, ocellar spots obsolete [21] Pronotum narrowing very slightly more cephalad than caudad, surface somewhat flattened mesad. Tegmina narrow, costal and sutural margins gradually converging to the rather broadly rounded apex, supplied with (four) longitudinal discoidal sectors, cross veinlets distinct but not raised, as are all the veins Wings with venation of medio-discoidal area simple, median and discoidal veins nearly parallel, joined by three transverse veinlets, the discoidal vein distad becoming suddenly almost transverse and joining the median vein, mediastine, costal and similar distal veinlets aggregating only eight veins to the costal margin, appendicular field distinctly longer than broad, its basal line transverse Supra-anal plate strongly transverse, feebly and broadly bilobate Subgenital plate with broad transverse sulcus and cleft valves, the latter with margins rounding and diverging distad, so that a V-shaped slit separates them there, from which projects another plate which is medio-longitudinally carinate [22]

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[18] A tendency toward such a type is shown by *Anaplecta pluto* here described

[19] In this feature agreement is found with the species of *Anaplecta* noted above, but not with the other known forms of that genus

[20] In the unique individual before us the distal spines of this margin can not be seen

[21] Possibly lost through discoloration

Head, pronotum and ventral surface blackish mummy brown, paling to prouts brown distad on abdomen. Antennae mummy brown, with eighteenth and nineteenth joints whitish [23] Tegmina translucent mummy brown, paling slightly distad Wings hyaline, area of costal veins to appendicular field tinged with prouts brown, the costal half of that field weakly and evenly tinged with ochraceous buff Tibiae and tarsi tawny olive

The female type measures; length of body 4 8, length of pronotum 1 3, width of pronotum 1 9, length of tegmen 4 8, width of tegmen 1 7 mm.

This very unusual species is known only from the type

PSEUDOMOPINAE

Ceratinoptera picta Brunner

1865 *Ceratinoptera picta* Brunner, Nouv Syst. Blatt , p 76, pl 1, figs 4*a* to 4*e*. [♂, ♀, Brasil]

St Laurent du Maroni, French Guiana, May, 1 ♀

This specimen has the striking pale crescent on the pronotum[24] and fully developed tegmina

Dendroblatta insignis new species. Plate XII, figure 10

This is one of the handsomest species of the South American Pseudomopinae It is much larger and heavier than the genotype, *D sobrina* Rehn, with distinctive pronotal and tegminal markings Another undescribed species now before us, from Trinidad and British Guiana, shows markings almost intermediate between those of *sobrina* and *insignis*.

Type · ♀; Godebert-Maroni, French Guiana. June. [Hebard Collection, Type no. 994.]

Size large, form deplanate and broad for the genus Head flattened, its lateral margins converging ventrad below the large eyes, interocular space very narrow, slightly wider than proximal antennal joint, ocellar spots subobsolete Maxillary palpi with fourth joint nearly as long as fifth, the latter obliquely truncate to near its base Pronotum subelliptical, greatest width meso-caudad, discal sulci obsolete Tegmina ample, reaching extremities of cerci, rather coriaceous in dark portions, veins very numerous, discoidal sectors oblique Wings reaching as far caudad as tegmina Supra-anal plate trigonal, but with apex strongly bilobate Subgenital plate simple, produced between the cerci with margin convex Ventro-cephalic margin of cephalic femora irregularly armed proximad with a few short but moderately heavy spines, these irregular in length also but gradually decreasing and followed by a similarly irregular series of very short spines, interspersed with spinulae, terminated with two elongate distal spines, ventro-caudal margin armed in distal half with three well spaced spines Fourth tarsal joint of caudal limbs alone bearing a pulvillus Tarsal claws simple, symmetrical, arolia large

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[22] We find a similar development in the female sex of *A. asema* Hebard.

[23] The number of antennal joints can not be determined as their apices are missing.

[24] Figured by us, Trans. Amer Ent Soc , XLII, p. 129, (1916) in a discussion of the genus.

Head, antennae, palpi and limbs ochraceous buff, except eyes and a broad interocular band which are blackish mummy brown Ventral surface of abdomen ochraceous buff becoming tawny distad and subgenital plate with a suffusion of mars brown distad on each side Pronotum with lateral and narrow cephalic margins translucent ochraceous buff, disk outlined in blackish brown, this outline narrow in cephalic portion but broad elsewhere and caudad spreading to include the caudal margin of the pronotum between the humeral shoulders; a broad, transverse bar of blackish brown also crossing the disk meso-cephalad, leaving a narrow transverse fusiform area cephalad and a much larger oval area caudad of rich ochraceous-buff, the latter with a minute point of blackish brown on each side invading it from the dark transverse bar Tegmina translucent ochraceous buff paling distad, strikingly marked as follows, a broad and somewhat irregular oblique band, with base the discoidal vein, running to sutural margin, in such a way that the anal vein lies mesad in it, thence continued more narrowly a short distance along the sutural margin and then expanding to again include all but the broad sutural and broader distal margins, as well as a portion of the area of the dextral tegmen concealed when at rest This large and striking marking is largely blackish brown, paling to rich russet toward the sutural margins of the tegmina, it occupies about half the tegminal surface and is roughly X-shaped when the tegmina are closed.

A Peruvian female before us agrees very closely, and its measurements follow those of the type female, length of body 16 and 14 3, length of pronotum 4 8 and 4 6, width of pronotum 7 and —, length of tegmen 15 and 13 9, greatest tegminal width 5 9 and 5 4 mm.

Besides the type, there is in the author's collection a female from

Yurimaguas, Huallaga River, Peru, taken March 25, 1920, by H S Parish

Dendroblatta onephaia new species. Plate XII, figures 11 and 12

This insect differs signally from the other known species of *Dendroblatta* in the general dusky coloration, unrelieved by any striking markings The male genitalia are also distinctive

Type ♂, Nouveau Chantier, French Guiana May. [Hebard Collection, Type no 995]

Size medium, form deplanate and broad for the genus, surface shining Head as here described for *D insignis* except as follows ocellar spots prominent Maxillary palpi with fourth joint distinctly shorter than fifth, the latter obliquely truncate almost to base Pronotum subelliptical, greatest width caudad of median line, discal sulci weak but distinct Tegmina ample, exceeding apex of abdomen by pronotal length, veins very numerous, discoidal sectors oblique Wings reaching as far caudad as tegmina Subgenital plate briefly produced and bearing two very large, irregularly lamellate styles, each of these styles is bent mesad, so that their rounded apices are attingent Ventro-cephalic margin of cephalic femora armed proximad with two (number probably individually variable) small, stout, irregularly placed spines, followed by an even series of minute spines, terminated by two large, elongate distal spines, ventro-caudal margin armed in distal half with (four to five) well spaced spines Pulvilli, tarsal claws and arolia as in *insignis*

Allotype ♀, Roches de Kourou, French Guiana [Hebard Collection]

Agrees closely with male in ambisexual characters, differing as follows Form broader Interocular space nearly twice width of proximal antennal joint Tegmina and wings reduced, very slightly surpassing apex of abdomen, the former more coriaceous Supra-anal plate transverse, triangularly produced, but with apex bilobate, so that mesad there is a decided V-emargination. Subgenital plate simple, produced between cerci, with margin convex but curled upward to some extent laterad, so that in ventral aspect the margin of the produced portion appears angulate.

Head deep mummy brown, ocellar spots ochraceous buff Antennae mummy brown, paling to dresden brown proximad Ventral surface mummy brown, paling to cinnamon brown on abdomen. Limbs prouts brown. Pronotum with lateral margins ochraceous buff, weakly translucent, other portions solidly blackish brown Tegmina chestnut brown, paling gradually toward margins, marginal field weakly translucent, ochraceous buff The female allotype is more reddish ventrad, the paler portions being russet.

The measurements of a male paratype follow those of the type length of body ♂ 14 8 and 15, ♀ 13 4, length of pronotum ♂ 3 8 and 3 9, ♀ 3 9, width of pronotum ♂ 5 7 and 5 8, ♀ 5 9, length of tegmen ♂ 14 9 and 14 7, ♀ 11 2, width of tegmen ♂ 4 7 and 4 8, ♀ 4 8 mm

In addition to the described pair, a male paratype is before us, taken at St Jean du Maroni, French Guiana, in February

Eudromiella inexpectata (Rehn) Plate XIII figures 1 and 2

1906 *Blattella inexpectata* Rehn, Proc Acad Nat Sci Phila, 1906, p 268 [♀, Demerara, British Guiana]

Nouveau Chantier, French Guiana, June and July, 2 ♂, August, 1 large juv ♀

St Jean du Maroni, French Guiana, February, 1 ♂, 1 ♀, 1 large juv ♀

Recognition of the male sex enables us to place this species generically It represents a group very distinct from that of the other known species of the genus, in having the pronotum and tegmina wholly immaculate

Being of a more reddish brown, with pronotal convexity more distinct than in any of the species of *Neoblattella*, this insect shows nearest, though purely superficial, resemblance to some of the species of *Symploce*

For species so dissimilar in general appearance, the male subgenital plate and styles show remarkable similarity to those of *E chopardi* here described, *inexpectata*, however, having the projections of the subgenital plate less erect and somewhat different in contour

The interocular space is slightly over one-third as wide as the space between the antennal sockets in the male, nearly three-quarters as wide as that space in the female The male has the sixth abdominal tergite highly specialized The measurements of the figured male are as follows length of body 10 8, length of pronotum 3 1, width of pronotum 4, length of tegmen 12 2, width of tegmen 3 9 mm

Eudromiella chopardi[26] new species. Plate XII, figures 13 to 15

This species closely resembles the Panamanian genotype *E bicolorata* Hebard In fact material before us shows that there are a number of South American species of this genus, all agreeing very closely in the strikingly bivittate pronotum, bicolored tegmina and wings with area of enlarged portions of costal veins strikingly pale

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[26] Named in honor of our friend Dr Lucien Chopard, through whose kindness we have been enabled to study the present collection

It may be separated from *bicolorata* by the average slightly greater size, immaculate head, narrower interocular space and distinctive styles of the male subgenital plate

Type. ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 996]

Interocular space three-fifths as wide as width between antennal sockets Ocellar spots distinct Maxillary palpi with fifth joint slightly shorter than fourth Tegmina and wings fully developed, extending beyond abdomen a distance equal to twice the cercal length, the former with numerous oblique discoidal sectors. Sixth abdominal tergite with a decided median concavity, having on the caudal face a minute, triangular, ridge-like projection, cephalad of which is a heavy tuft of agglutinated hairs, seventh and eighth tergites transversely narrower, exposed only narrowly along their caudal margins Supra-anal plate transverse, basal width three times length, triangularly produced with apex distinctly bilobate Subgenital plate asymmetrical; free margin irregularly convex in large portion and curled dorsad so that the styles can not be seen from below, dextral portion, however, forming a subrectangulate projection beneath the dextral style, the dextral margin thence straight to base of plate Sinistral style represented by a triangular plate directed dextrad, slightly longer than its basal width, its external surface weakly convex Dextral style longer, with margins showing slight convexity, directed dorso-sinistrad and twisted so that its sinistral surface lies against a small triangular flap which fills the space between the styles, apex of dextral style terminated in a minute tooth directed dextrad Limbs and other features as given in generic description[26]

Allotype. ♀; same data as type [Hebard Collection]

Very similar to male, differing in the tegmina and wings, which extend only briefly beyond the cercal apices Interocular space wider, three-quarters as wide as that between the antennal sockets Supra-anal plate strongly transverse, very weakly triangularly produced, with a large U-shaped median emargination. Subgenital plate simple, margin rather decidedly concave beneath styles, strongly convex between them.

Head, palpi, ventral surface and limbs ochraceous tawny Eyes blackish Antennae with first two joints ochraceous tawny, thence suffused with mummy brown, paling gradually distad, with distal portion ochraceous tawny. Pronotum with two broad longitudinal bars of blackish chestnut brown, which broaden and diverge slightly caudad throughout their length; intervening area ochraceous buff tinged with orange, lateral margins translucent, tinged with ochraceous buff Tegmina translucent, ochraceous tawny, toward the humeral trunk deepening to cinnamon brown, this darker portion running straight to tegminal apex, thus occupying half of the scapular field distad; remaining costal marginal portions translucent, tinged with ochraceous buff Wings faintly tinged with prouts brown, the area of the enlarged portions of the costal veins strikingly pale, opaque, buffy

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[26] Mem. Amer Ent. Soc., No. 4, p. 35, (1919).

The measurements of the described pair are as follows length of body ♂ 10 8, ♀ 10 8, length of pronotum ♂ 3 2, ♀ 3 3, width of pronotum ♂ 3 9, ♀ 4, length of tegmen ♂ 12 5, ♀ 11, width of tegmen ♂ 3 7, ♀ 3 7 mm The tegminal length in the paratypes varies as follows, ♂ 11 3 to 12 6, ♀ 10 3 to 10 7 mm

In addition to the described pair, a paratypic series of six males and six females, bearing the same data, has been studied.

Eudromiella maroni new species. Plate XII, figures 16 and 17.

This insect agrees closely with *E bicolorata* Hebard in size and general appearance, differing in having the interocular-ocellar area suffused, this darkened portion extending higher and the face below paler, the interocular space much narrower (distinctly narrower than in *E chopardi* here described), and in the distinctive styles of the male subgenital plate The form of the apex of the dextral style and narrowness of the interocular space indicates somewhat closer affinity to *chopardi*

Type ♂, Nouveau Chantier, lower Maroni River, French Guiana June [Hebard Collection, Type no 997]

Agrees closely with *chopardi* except as follows Size slightly smaller Interocular space only slightly more than one-third as wide as width between antennal sockets Ocellar spots weakly indicated (due to discoloration ?) Tegmina and wings fully developed, but extending beyond apex of abdomen only slightly more than one and one-half times the cercal length Subgenital plate asymmetrical, narrow marginal portion reflexed on each side to the strongly inset styles, the median portion moderately broad, similarly reflexed, with its free margin broadly convex, sinistral style represented by a rounded node, no longer than wide, above which projects a decurved chitinous spine,[27] dextral style represented by a somewhat lamellate finger terminating in an acute apex directed dextrad and bearing sinistro-proximad a minute, curved, chitinous spine. The length of this style is distinctly over twice that of the sinistral, both being smaller and less lamelloid than in *chopardi*

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[27] Though we can not say definitely, this spine appears to be a part of the concealed genitalia and not attached to the sinistral style If this is true the spine is probably movable and not always externally visible

Head ochraceous tawny, deepening to cinnamon brown in area between eyes and ocelli Ventral surface buffy, tinged with buckthorn brown, abdomen with a broad submarginal suffusion of dresden brown on each side Antennae with first two joints ochraceous tawny, thence weakly suffused with mummy brown, gradually paling distad Pronotum as described for *chopardi* Tegmina very similar to those of that species but showing a slightly less tawny shade Wings tinged with prouts brown, the area of the enlarged portions of the costal veins pale, opaque, suffused (discolored) buffy

The measurements of the unique male type are, length of body 9, length of pronotum 2 7, width of pronotum 3 8, length of tegmen 10 9, width of tegmen 3 6 mm

Macrophyllodromia nigrigena new species Plate XII figures 17 to 19

This handsome species is readily separated from the genotypic Mexican *M maximiliani* (Saussure) and the Panamanian *M splendida* Hebard by the solidly blackish face,[28] strikingly bicolored femora, dotted lateral portions of the pronotum and distinctive male genitalia

The general color pattern of all is similar, but the two dark pronotal bands fuse at the caudal margin in *splendida*, are very briefly separated in *nigrigena* and are well separated in *maximiliani* Neither *splendida* nor *nigrigena* show comparatively large tegminal maculae, as does *maximiliani*

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 998]

Size and form much as in *maximiliani*, larger than in *splendida* Interocular space one-quarter as wide as that between antennal sockets Ocellar spots rather large, distinct Maxillary palpi with fifth joint four-fifths as long as fourth, proportionately longer in *splendida* Tegmina and wings ample and fully developed Supra-anal plate with length nearly one-third basal width, triangularly produced between cerci but strongly bilobate at apex Concealed genitalia complex. Subgenital plate asymmetrical, structure intricate, sinistral margin rounded; thickened and produced distad in a large sharp horn which curves dextrad, distal margin at base of that process strongly concave and there seating sinistral style, thence transverse, with a large rounded node dorsad (which apparently acts as a support to the sinistral style), to a rounded V-emargination, in which the dextral style is seated; brief dextral margin rounded rectangulate emarginate Dextral style large, springing from a stout base and produced as a very heavy finger sinistrad to above base of sinistral style, its outer face deeply grooved Sinistral style also with a very heavy base, from which springs dorso-dextrad a very heavy flattened spine, which is directed dextrad and, lying in the groove of the dextral style, reaches the median portion of the base of that style Other features as characteristic of the genus[29]

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[28] In one female before us there is a buffy interocular fleck.

Allotype ♀, St Laurent du Maroni, French Guiana October [Hebard Collection]

Size slightly larger, form much broader than in male Interocular space wider, slightly over one-third width between antennal sockets Tegmina and wings showing some reduction, though still exceeding abdominal apex by a considerable space Supra-anal plate much like that of male, but even more deeply V-emarginate at apex Subgenital plate simple, margin feebly concave below cerci, between them strongly convex, pinched briefly at apex, forming a brief longitudinal carina (there probably cleft)

Head blackish brown, vertex, ocellar spots and bases of mandibles buffy, allotype alone with a buffy spot above bases of mandibles and another female with a buffy interocular fleck Antennae dresden brown, paling proximad but there washed with prouts brown Eyes mars brown Maxillary palpi buffy marked with mummy brown Underparts blackish brown, the abdomen paling toward buffy mesad in male, there burnt sienna in females Femora buffy with dorsal surface and ventral margins blackish brown, tibiae tawny suffused with brown dorsad, tarsi buff tinged with tawny, the proximal joints suffused with brown distad Pronotum with two broad longitudinal bands of blackish brown, which at the caudal margin suddenly expand so that they almost meet, interval between these ochraceous buff weakly tinged with orange, lateral portions translucent, tinged with buff, this area with cingulate margin and a few scattered flecks of blackish brown[30] Tegmina with marginal field translucent, tinged with buff, other portions rather strongly tinged with buckthorn brown having a tawny tone, the very numerous intervals between the veins proximad very finely and delicately buffy[31]

In the immature condition the coloration is buffy, the dorsal surface without pronotal bands and wonderfully pictured with blackish brown, this becoming more russet on the abdomen The face is black, but the occiput is buffy as well as a broad interocellar bar, leaving a still wider interocular bar of chestnut brown between[32]

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[29] See Hebard, Mem Amer Ent Soc, No 4, p 42, (1919)

[30] Such marking in the lateral portions of the pronotum is a very unusual occurrence in the Blattidae

[31] This condition is also shown in *splendida*, but over a lesser area and there very faintly.

[32] We now know that, in some of the species of the Pseudomopinae having strikingly marked adults, the immature stages are very differently, though quite as strikingly, marked

The measurements of a paratypic female, bearing the same data as the type, follow those of the allotype Length of body ♂ 18, ♀ 17 5 and 17 7, length of pronotum ♂ 5, ♀ 5 2 and 5 1, width of pronotum ♂ 6 9, ♀ 7 7 and 7 7, length of tegmen ♂ 21 8, ♀ 18 1 and 18 2, width of tegmen ♂ 6.8, ♀ 7 and 7 mm

Specimens Examined 8, 3 males, 3 females and 2 immature individuals

Kartabo, Bartica District, British Guiana, (all Wm Beebe), 1 ♂, 2 juv ♂, August 15, 1922, 1 ♂, June 12, 1922, (under bark, Haka's trail), 1 ♀, [all A N.S P.]

St Jean du Maroni, French Guiana, 1 ♂, 1 ♀, *type* and *paratype*.

St Laurent du Maroni, French Guiana, October, 1 ♀, *allotype*

Chromatonotus notatus (Brunner)

1893. *P[hyllodromia] notata* Brunner, Proc Zool. Soc London, 1893, p 602, pl LII, figs 1*a* and *b* [♂, ♀, St Georges and Balthasar, Grenada, British West Indies.]

St. Jean du Maroni, French Guiana, January, 1 ♂

St Laurent du Maroni, French Guiana, December, 1 ♂

Nouveau Chantier, French Guiana, August and October, 1 ♂, 2 ♀

These individuals agree closely with a series before us from the Island of Trinidad, except in the average slightly smaller size[33] In some the facial markings are decidedly more obscured than in others, possibly due to discoloration

The head is normally dark brown with a moderately broad, transverse interocular band of buffy, in diameter reaching from the ventral portions of the ocellar spots to the median portion of the antennal sockets This band is frequently followed ventrad by a narrower band of blackish brown, which is, however, often vague.

Anisopygia decora new species. Plate XIV, figure 14

The elongate, trigonal, lateral tegminal pads, and maculations of the metanotum and distal portion of the abdomen readily distinguish females of this species from all the American species which have been described as members of the genera *Loboptera* Brunner or *Temnopteryx* Brunner[34] A nearly adult male before us has no lateral production of the mesonotum The adult of this sex has, therefore, probably similar tegminal pads

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[33] For a discussion of the genus see, Mem Amer. Ent Soc., No. 4, p. 44, (1919)

[34] Saussure's Argentinian *Paraloboptera* lacks arolia between the tarsal claws.

Care must be taken, whenever considering the present genus, to avoid placing here brachypterous females of certain species of *Ischnoptera* Burmeister

Type ♀; Roches de Kourou, French Guiana [Hebard Collection, Type no 1035]

Size small, form broad, eyes widely separated and in even convexity with vertex, ocellar spots vague and not defined by contour Interocular space very slightly wider than that between antennal sockets Maxillary palpi short, with fifth joint equal in length to fourth and nearly three-quarters as long as third Antennae slender Pronotum broad and very evenly convex, cephalic margin truncate, lateral margins broadly convex and divergent caudad, rounding sharply into the broadly convex, transverse caudal margin Tegmina represented by minute, elongate, trigonal lateral pads, (approximately) twice as long as proximal width, the rather sharply rounded apices slightly surpassing caudal margin of mesonotum Abdomen with latero-caudal margins of tergites feebly produced, of the seventh tergite strongly rectangulate produced, free margin of that tergite bracket shaped Supra-anal plate very narrow, length less than one-fourth proximal width, free margins very strongly oblique to the moderately bilobate apex Cerci fusiform, lateral margins almost entire Subgenital plate ample, free margin broadly convex to a minute median emargination, the sides of which are raised and rounded with a rounded notch between Limbs short and stout Ventro-cephalic margin of cephalic femora armed with a series of heavy, elongate spines, succeeded by a row of moderately well-spaced, minute spines, terminating in three heavy, elongate, distal spines, other ventral femoral margins well supplied with stout, elongate spines Caudal metatarsus with two ventral rows of minute, chaetiform spines Four proximal tarsal joints each with a small pulvillus distad Moderately large arolia present between the simple, symmetrical tarsal claws

General coloration of dorsal surface deep shining chestnut brown Pronotum paling (in two individuals to different degrees) to ochraceous tawny in a small suffused area above head, lateral portions paling to transparent buckthorn brown Mesonotum with a small, irregular, oblique marking mesad on each side of ochraceous buff, these markings reduced to dots in one female Head russet, the vague ocellar spots ochraceous buff tinged with tawny Antennae and palpi ochraceous buff, the former becoming buckthorn brown distad. Cerci (except their immediate bases) and apex of abdomen ochraceous buff, this covering all of the supra-anal plate except its apices and dots at bases of cerci, all but median and proximo-lateral portions of the preceding (sixth) exposed tergite and broad latero-caudal portions of the fifth tergite. Limbs and ventral surface deep shining chestnut brown, the former with joints and extremities paling to ochraceous tawny

The irregularity of the striking pale dorsal markings gives to this species an unusual appearance

The measurements of the female type are followed by those of a paratype of the same sex Length of body 8 2 and 8 3, length of pronotum 2 8 and 2 8, width of pronotum 4 2 and 4 2, exposed length of tegmen 1 5 and 1 4, proximal width of tegmen 8 and 8 mm

Specimens Examined 3, 2 females and 1 immature individual

St Jean du Maroni, French Guiana, 1 large juv ♂

St Laurent du Maroni, French Guiana, 1 ♀, *paratype*

Roches de Keurou, French Guiana, 1 ♀, *type*

Sciablatta galibi new species Plate XIV, figure 15

This insect agrees closely with the Colombian genotype *S mamatoco* Hebard, that insect differing in the smaller size, paler coloration, slightly wider interocular space, even more nearly immaculate pronotal disk and slight differences in the generally similar male genitalia

Superficially resembling certain species of the Adspersicollis Group of *Neoblattella* Shelford, *galibi* may be distinguished by the many important generic features of difference [35]

Type ♂, St Jean du Maroni, French Guiana November [Hebard Collection, Type no 1015]

Size large for the genus, form broad Interocular space two-thirds that between antennal sockets Inter-ocular-ocellar area flattened Ocellar spots present, their areas showing no definition of contour Lateral margins of cheeks weakly convergent ventrad. Maxillary palpi with fourth joint slightly shorter than third, fifth distinctly shorter than fourth Pronotum rather strongly transverse, though not as much so as in *mamatoco*, lateral margins very evenly convex, greatest width slightly caudad of median line Tegmina and wings fully developed, extending beyond cercal apices a distance nearly equal to that of the elongate, slender cerci Veins of tegmina very numerous, the discoidal sectors oblique Wings with costal veins weakly thickened distad, as in *mamatoco*, intercalated triangle moderately large, the ulnar vein with (ten) complete branches Sixth abdominal tergite showing mesad a large and broad, shallowly concave area, the surface of which is carpeted with agglutinated hairs Supra-anal plate triangularly produced between cerci, unlike *mamatoco* having the lateral margins very feebly concave and the apex broadly and weakly bilobate Subgenital plate with surface feebly convex, this increasing to the narrowly reflexed latero-distal portions, the sinistral margin almost straight to the styles, the dextral margin broadly bisinuate Styles represented by erect rounded plates, each slightly longer than wide, their external surfaces strongly concave, their internal surfaces moderately convex The brief median portion of the free margin of the subgenital plate between these is triangularly produced dorsad, with apical portion drawn out into a more strongly chitinous hook which curves caudad to its acute apex Ventro-cephalic margin of cephalic femora armed with large spines, which decrease in size gradually distad Four proximal tarsal joints supplied with large pulvilli A large arolium present between the simple, symmetrical tarsal claws

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[35] See Trans. Amer Ent Soc , XLVII, p 115, (1921)

Head clay color, marbled with ochraceous tawny between the eyes Ventral surface and limbs tawny olive, deepening to bister proximad on abdomen Pronotum with disk ochraceous tawny, a pair of flecks mesad and two smaller and more adjacent flecks meso-caudad of prouts brown, lateral portions transparent faintly tinged with buffy Tegmina transparent tinged with buffy, with everywhere between the veins fine interrupted lines of dull ochraceous tawny [26] Wings transparent, the veins buffy Abdomen dorsad buckthorn brown deepening to mummy brown laterad, but with the immediate lateral margins buckthorn brown

The measurements of this unique male type are, length of body 13 2, length of pronotum 3 9, width of pronotum 5 3, length of tegmen 15 2, width of tegmen 5 mm.

Sciablatta poecila Hebard

1921 *Sciablatta poecila* Hebard, Proc Acad Nat Sci Phila, 1921, p 196, pl IX, figs 12 to 15 [♂, St Jean du Maroni, French Guiana]

Kartabo, Bartica District, British Guiana, (Wm Beebe), 1 large juv ♂, [A N S P]

St Jean du Maroni, French Guiana, 1 ♂, taken with type

The entire dorsal surface of the immature individual is as beautifully and finely dotted as the head and pronotum in the adult The antennae in the instar before us are buffy brown proximad, followed by twelve joints of blackish brown, then with a white annulus of equal length, succeeded by eight joints of blackish brown, the remaining distal portion again buffy brown

Cariblatta personata Rehn

1916 *Cariblatta personata* Rehn, Trans. Amer Ent Soc, XLII, p 228, pl XIV, figs. 9 and 10 [♀, Ceará Mirim, Rio Grande do Norte, and Independencia, Parahyba, Brasil]

San Jean du Maroni, French Guiana, 3 ♀

Without males from either Brasil or French Guiana, the specific identity of this material can not be definitely proven The general resemblance of the five specimens concerned is so close, however, that such seems probable in spite of the wide separation of the localities and their different climates

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[26] Such delicate tegminal markings are found in all the species of the genus

Dried after immersion in alcohol, the originally described specimens are somewhat shrunken The female subgenital plate normally has a brief rounded emargination at its apex, we believe, as is true for the specimens here recorded The head, when not discolored, not only has a broad interocular band of darker brown, but this is also margined ventrad by a striking band of light buff of almost equal width This latter is almost effaced in the Brazilian specimens, clearly due to discoloration In two of the present examples the pronotal color pattern is subobsolete, mere traces of the longitudinal markings caudad being apparent[27] Abdomen strikingly colored, as originally described

This species appears to have no close affinities It is more tawny in general coloration than is usual, as is the Jamaican *C cuprea* Hebard It is smaller than that species and is readily separated from it by several striking features of color pattern.

NEOBLATTELLA Shelford

For some time we have realized that the genus *Neoblattella* Shelford would probably require further division, but the number and diversity of the species has prevented further action to that taken in 1916, when we removed a number of the previously included species to a new genus, *Cariblatta*[28]

Subsequent acquisition of topotypic material of *adspersicollis* (Stål), genotype of *Neoblattella*, affords us a much better working basis, while all but a small number of the described forms are now in the collections before us, or have been definitely placed as members of other genera of this difficult section of the Pseudomopinae.

Comparison of the species hitherto referred to *Neoblattella* shows that, in the great majority, important differences from *adspersicollis* exist So many species show such decided individual differentiation, however, that we do not yet feel warranted in proposing further division until a general revision of the group has been undertaken

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[27] The longitudinal character of these markings is one of the most valuable characters for separating *personata* from other species of the genus.

[28] Trans. Amer. Ent Soc , XLII, pp. 147 to 186

Of the previously described species, those nearest *adspersicollis* are; *pellucida* (Burmeister), *puerilis* (Rehn), *tapenagae* Hebard, *nahua* (Saussure and Zehntner) and *fraterna* (Saussure and Zehntner)

Neoblattella litosoma new species Plate XIII, figures 7 and 8

This insect is apparently a member of the Impar Group The male subgenital plate, though not as highly specialized as in most of the species there included, however, is of a distinctive type The tegminal cross-veinlets are also very conspicuous distad, unusually so for that Group

The general coloration is more grayish than in most species of *Neoblattella* Little else is strikingly prominent, except the structure of the male subgenital plate and styles

Type ♂, Nouveau Chantier, French Guiana May [Hebard Collection, Type no 1000]

Size medium for this group of smaller species, form rather slender. Interocular space slightly over half width between antennal sockets Interocular-ocellar area appreciably flattened Maxillary palpi very elongate, third and fourth joints subequal in length, fifth three-quarters as long as fourth. Pronotum with lateral margins very broadly and evenly convex, point of greatest width mesocaudad Tegmina with (six) longitudinal discoidal sectors, cross-veinlets distinct and darkened in distal portions and in area of dextral tegmen concealed when at rest Wings with costal veins heavily clubbed distad Subgenital plate with lateral margins obliquely convergent, first convex then concave to a sudden, roughly rhombiform, median emargination, the projections thus formed on each side with apices rounded, the dextral more produced than the sinistral On the transverse base of the distal emargination are situated the two, very similar and very small styles, which are almost attingent, rounded, about as wide as long and armed dorsad with microscopic spines The surface of the subgenital plate is convex at the base of these styles, concave in the very brief intervening space Ventro-cephalic margin of cephalic femora armed with elongate spines which gradually decrease in size distad, terminated in two elongate spines, ventro-caudal margin armed with three elongate spines. Limbs, pulvilli and arolia as normal in the genus. Tarsal claws with flange moderately developed, its teeth very weak.

Allotype: ♀, same data as type but taken in July [Hebard Collection.]

Very similar to the type, very slightly larger Interocular space slightly less than two-thirds width between antennal sockets Tegmina and wings fully as caudate Supra-anal plate roundly emarginate at apex Subgenital plate moderately elongate, lateral margins convex, then markedly concave beneath the cerci, median portion produced, lateral margins thickly supplied proximad with chaetiform spines

General coloration buffy tinged with tawny olive, but in appearance distinctly more grayish than is usual in the genus Head cinnamon with a broad interocular band of snuff brown and another narrow band of the same outlining the ventral margin of the interocellar area (head clearly much discolored) Limbs and underparts tawny olive Male with proximal abdominal sternite having a very broad blackish brown suffusion, each succeeding sternite with a smaller such marking to the penultimate, where it is reduced to a median spot, a submarginal suffusion of brown also extends to the penultimate sternite Female with ventral surface of abdomen unicolorous Pronotum with disk showing the usual picturing moderately well defined, but cephalad with a suffused square of darker brown on each side and with the five meso-caudal dots decided Tegmina immaculate, except for the distal cross-veinlets which are prouts brown, as are those in the portion of the dextral tegmen which is concealed when at rest

The type and allotype measure length of body ♂ 10 3, ♀ 10 4, length of pronotum ♂ 2 5, ♀ 2 8, width of pronotum ♂ 3 7, ♀ 3 7, length of tegmen ♂ 11 7, ♀ 11 9, width of tegmen ♂ 3 2, ♀ 3 7 mm

A female is before us from the same locality which agrees almost exactly with the allotype, except that the interocular width is fully five-sixths that between the antennal sockets It is very possible that an allied species is represented, in which case the male genitalia would probably show striking differences, as is true of the allied species of the Impar Group known from Panama

Neoblattella titania (Rehn) Plate XIII, figure 6.

1903 *Blattella titania* Rehn, Trans. Amer Ent Soc , XXIX, p 267 [♂; Bartica, British Guiana]

St Jean du Maroni, French Guiana, 2 ♂, 2 ♀

We have placed this species in the Carrikeri Group,[39] though the smaller size and very different specialization of the male subgenital plate may oblige its removal and the recognition of still another group in this remarkable genus The female of *titania*, now known for the first time, indicates that such action will be necessary, as little general difference from the male is shown, whereas the sexes in the Colombian *N carrikeri* Hebard are very dissimilar.

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[39] See Trans. Amer Ent Soc , XLV, p. 100, (1919).

The female of *titania* is scarcely larger than the male The interocular space is wider, three-quarters as wide as that between the antennal sockets The produced subgenital plate is much as here described for *N nodipennis*, its proximo-lateral margins thickly supplied with chaetiform spines

We here figure the intricately specialized and highly asymmetrical subgenital plate of the male

In this species the flange of the tarsal claws is moderately well developed, with teeth minute

The measurements of the type are given before those of a male here recorded Length of body ♂ 12[40] and 10 2, ♀ 10 8, length of pronotum ♂ 2 7 and 2 3, ♀ 2 8, width of pronotum ♂ 3 6 and 3 2, ♀ 3 8, length of tegmen ♂ 12 2 and 11 6, ♀ 11 9, width of tegmen ♂ 3 4 and 3 3, ♀ 3 9 mm

Neoblattella nodipennis new species Plate XIII, figures 3 to 5

This insect is apparently nearest certain West Indian species having the male subgenital plate intricately specialized but symmetrical Unlike them, however, the tegmina show numerous small nodes distad These nodes are larger and much more conspicuous than in *N conspersa* (Brunner) and *N platystylata* Hebard, but are of the same general character As a result we would place *nodipennis* in a group between the Detersa and Conspersa Groups

The coloration of the head in *nodipennis* is distinctive

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 999]

Size medium small for the genus, somewhat larger than *platystylata*, form moderately slender Interocular space narrow, two-thirds that between the antennal sockets Ocellar spots distinct Maxillary palpi elongate, fourth joint shorter than third, fifth about two-thirds as long as fourth Pronotum with surface very weakly convex, greatest width scarcely caudad of median point, angulation in curvature of lateral margins apparent Tegmina very delicate, with (eight) longitudinal discoidal sectors and a few spurious veins between, distal portions well supplied with scattered darkened nodes, these continued as smaller dark flecks to base of humeral trunk Wings with costal veins well clubbed distad Supra-anal plate weakly produced, the free margin almost evenly and broadly convex Preceding tergite simple, the next developed into two transverse lobes, the surfaces of which are depressed toward their adjacent extremities, preceding tergite depressed, with scattered hairs mesad Subgenital plate symmetrical, lateral portions produced caudad each in a small sharp spike, distal marginal portion transverse except for a rounded, horizontal production mesad about as long as wide at base, laterad becoming narrowly reflexed, to base of lateral projections,[41] there produced dorsad on each side in a small knobbed, style-like, non-articulate projection, the apex of which is curved caudad and is tipped with minute spines Ventro-cephalic margin of cephalic femora armed with rather delicate spines which gradually decrease in size distad, with some chaetiform, terminating in two elongate distal spines, caudal margin armed with three or four spines Limbs, pulvilli and arolia as characteristic of the genus Tarsal claws symmetrical, the flange weakly developed and weakly armed with a few minute teeth

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[40] Body crushed in type

Allotype ♀, Gourdonville, French Guiana October, 1914 (R Benoist) [Hebard Collection]

Agrees closely with male Size slightly larger Interocular space broad, three-fifths width between antennal sockets Subgenital plate elongate, lateral margins convex, then markedly concave beneath cerci, the median portion well produced with apex broadly rounded

General coloration pale buckthorn brown Head ochraceous buff with a broad interocular band of prouts brown, broadly margined both dorsad and ventrad (in individuals not discolored) with light ochraceous buff Ventral surface and limbs ochraceous buff, the tibiae flecked with prouts brown Pronotum with disk ochraceous buff tinged with tawny, the usual generic picturing weakly indicated in suffusions of cinnamon brown, lateral portions transparent, very faintly tinged with brownish Tegmina as the latter, the nodes ochraceous tawny deepening proximad so that the smaller flecks there are cinnamon brown

The measurements of the male type are followed by those of a male paratype, taken at Charvein, lower Maroni River, French Guiana, in May Length of body ♂ 11 3 and 10 8, ♀ 13, length of pronotum ♂ 2 8 and 2 8, ♀ 2 9; width of pronotum ♂ 3 9 and 4, ♀ 4; length of tegmen ♂ 13 3 and 13 4, ♀ 13.5; width of tegmen ♂ 3 8 and 3 9, ♀ 4 mm

Neoblattella conspersa (Brunner)

1865. *Ph[yllodromia] conspersa* Brunner, Nouv. Syst. Blatt., p. 106. [♂, Brasil]

Charvein, lower Maroni River, French Guiana, May, 1 ♂.

Nouveau Chantier, French Guiana, May and September, 1 ♂, 1 ♀.

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[41] Styles are not visible. If present they lie concealed between the lateral and distal portions of the plate

St Jean du Maroni, French Guiana, 1 ♂, 1 ♀

This species is known southward to the Argentine Republic [42]

Neoblattella platystylata Hebard

1921 *Neoblattella platystylata* Hebard, Proc Acad Nat Sci Phila., 1921, p 229, pl IX, figs 21 to 23, pl XI, fig. 1. [♂, ♀ Bartica, British Guiana, St Jean du Maroni and Charvein, French Guiana, Igarapé-Assú, Pará, Brazil]

Nouveau Chantier, French Guiana, January, February, June, July, August, September, October, November and December, 5 ♂, 13 ♀

St Jean du Maroni, French Guiana, January and June, 5 ♂, 13 ♀

Charvein, lower Maroni River, French Guiana, May, 2 ♀

Roches de Kourou, French Guiana, 2 ♀

St Laurent du Maroni, French Guiana, October, 1 ♀

This is evidently the most abundant species of *Neoblattella* in the Guianas

Neoblattella pellucida (Burmeister)

1838. *Bl[atta] pellucida* Burmeister, Handb Ent, II, Abth II, pt I, p 498. [Pará, Brazil]

St Jean du Maroni, French Guiana, January and May, 8 ♀, 1 juv

These adults are identical with topotypic females before us [43] We are satisfied that Burmeister's species has been correctly placed by Rehn

THE ADSPERSICOLLIS GROUP OF *Neoblattella*

We have been recently able to determine that, instead of a single widespread species, *N adspersicollis* (Stål), widely distributed over South America, a great number of large and striking species occur, showing close general resemblance These differ, however, greatly in degree and character of head and pronotal markings, contrast between the sexes and male genitalia Though all may be separated from the preceding groups by their greater size, different degrees of size and form also appear to be valuable for specific recognition

We had further supposed that the Nahua Group, distinguished from the present group only by high specialization of the male abdominal tergites, did not occur in South America Presence in the present collection of two new species of that group shows that, in studying South American material, one must further guard against confusing species of these two groups

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[42] We have recently discussed *conspersa*, Proc Acad. Nat. Sci Phila., 1921, p. 260, (1921)

[43] See Rehn, Trans Amer Ent Soc, XLII, p. 230, (1916).

We can definitely state that the table, supposed to show tegminal length variation in *adspersicollis*, which we gave in 1921,[44] is based on material of several species, the pair from Rio de Janeiro, Brazil, alone being referable to the genotype

Neoblattella poecilops new species Plate XIII, figures 9 to 12

This species is particularly distinguished by the strongly and contrastingly marked head and pronotal disk The interocular space is very narrow and the male subgenital plate, though having a node before each style, does not have the median portion produced as in the species of nearest relationship, *N binodosa* here described The tegmina and wings show no reduction whatever in either sex

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1001]

Size large and form broad Interocular space narrow, two-fifths width between antennal sockets and three-fifths vertical depth of dorsal portion of eye Ocellar spots distinct Maxillary palpi with fourth joint slightly shorter than third, fifth four-fifths as long as fourth Pronotum with convexity of lateral margins strongest and point of greatest width meso-caudal Tegmina and wings fully developed, the former with (thirteen) longitudinal discoidal sectors, the latter with costal veins not clubbed distad Dorsal surface of abdomen with narrowly visible seventh tergite having its caudal margin notched and raised mesad, the preceding tergite subchitinous and rounded obtuse-angulate emarginate before this Supra-anal plate with lateral margins oblique and undulate, then with median portion suddenly produced and bilobate, its margins faintly convex, not convergent, its length equal to half its basal width Concealed genitalia apparently complex Subgenital plate with lateral portions reflexed, their margins straight and declivent to the similar, socketed, straight, simple styles, which are over four times as long as their basal width, median portion of margin straight, transverse, but with a weak, rounded node just before the style on each side Ventro-cephalic margin of cephalic femora with a row of long spines which gradually decrease in size distad and terminate in three elongate spines, ventro-caudal margin with five spines Tarsal claws with heavy flange armed with well-developed teeth

Allotype ♀, Nouveau Chantier, French Guiana October [Hebard Collection]

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[44] Proc Acad Nat Sci Phila., 1921, p 232

Agrees closely with male, differing as follows Interocular space three-fifths width between antennal sockets Tegmina with fourteen discoidal sectors, some the result of distal branching Dorsal surface of abdomen unspecialized Supra-anal plate deeply U-emarginate meso-distad, the lateral apices rounded Subgenital plate simple, lateral margins broadly convex, then very broadly concave below cerci, median portion weakly produced and rather broadly convex

Head cinnamon brown deepening between antennae to chestnut brown, two narrow convergent streaks on occiput, ocelli, a triangular spot between antennal sockets, a broad crescent below this and mouthparts buffy Maxillary palpi buffy, their ventral surfaces suffused with blackish brown Limbs buffy, femora and tibiae suffused dorsad with prouts brown, apices of all but last joint of tarsi tipped with a suffusion of the same Abdomen prouts brown, each segment with a suffusion of buffy laterad, containing a fleck of dark brown Pronotum with disk ochraceous buff, so heavily overlaid and pictured with chestnut brown that only a median streak cephalad, a median area laterad and larger paired areas meso-caudad of the paler coloration are visible Tegmina and wings immaculate, when closed appearing translucent cinnamon brown, the lateral margins of the former and of the pronotum transparent, weakly tinged with buffy showing a very faint tawny tincture

The measurements of a paratypic female, bearing the same data as the allotype but taken in February, follow those of the allotype Length of body ♂ 16 5, ♀ 15 6 and 15 5, length of pronotum ♂ 4 6, ♀ 4 9 and 4 9, width of pronotum ♂ 6, ♀ 6 2 and 6 2, length of tegmen ♂ 18 7, ♀ 19 2 and 19, width of tegmen ♂ 5 4, ♀ 5 9 and 5 9 mm

Neoblattella binodosa new species Plate XIII, figures 13 to 16

Closely related to *N poecilops* here described, this insect may be easily distinguished by the wider interocular space, much less heavily marked head, larger pronotum with only a few dark dots in the disk, shorter tegmina and different male sexual characters, which are, however, of the same general type

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no. 1002]

Agrees with *poecilops* as described on page 164, except as follows Form slightly more robust. Interocular space very slightly less than three-fifths width between antennal sockets Pronotum more ample, point of greatest width meso-caudad, the lateral margins there showing greatest convexity and some slight angulation Tegmina and wings fully developed, though not fully as elongate, the former with as many discoidal sectors Dorsal surface of abdomen with similar specialisation, but with notching of seventh tergite not raised Supra-anal plate similar, except that the median portion is much less sharply produced, bilobate, but with lateral margins convergent and length distinctly less than half its basal width Subgenital plate very similar, except that the lateral portions are not reflexed and the nodes before the styles are more prominent

Head buffy, marked with chestnut brown as follows· a broad interocular band, a narrow inter-ocellar band, a pair of obliquely placed twin flecks below on each side and three flecks on each side of the face Limbs buffy with a tawny tinge, with large brown flecks at most spine bases Abdomen buffy with a broad submarginal suffused band of blackish brown on each side, the sternites with a transverse median suffusion of brown mesad becoming smaller on each caudad, the subgenital plate suffused with dark brown mesad and in bands laterad which run to the nodes Dorsal surface of abdomen even more suffused with dark brown Pronotal disk ochraceous tawny, with sixteen very small, widely separated dots of mummy brown Tegmina and wings immaculate, when closed appearing translucent buckthorn brown with a tawny tinge, the lateral margins of the former and of the pronotum transparent, weakly tinged with buffy showing a very faint tawny tincture

The male type measures, length of body 16, length of pronotum 4 9, width of pronotum 6 7, length of tegmen 17 3, width of tegmen 5 9 mm

Two large immature females are before us, bearing the same data

Neoblatella unifascia new species Plate XIII, figures 17 and 18

The present insect is distinctive in having the disk of the pronotum immaculate, the head immaculate except for a broad dark interocular bar, the exposed portions of the trochanters and all of the abdomen blackish brown, but the limbs largely very pale

Structurally it is smaller than *N binodosa* here described, with wider interocular space and, in the male, the sexual specialization is decidedly more simple

Type ♂; Nouveau Chantier, French Guiana December [Hebard Collection, Type no 1003]

Size rather small for this group of large species; form broad, normal, as robust as in *binodosa*. Interocular space two-thirds width between antennal sockets. Ocellar spots distinct Maxillary palpi, pronotum, limb spination and tarsal claws as described for *N poecilops* on page 164. Tegmina and wings much as in *binodosa*, the former with twelve discoidal sectors Dorsal surface of abdomen unspecialised Supra-anal plate roundly produced between cerci, flattened distad, with a trace of broad concavity, length equal to one-half total basal width Subgenital plate with lateral portions feebly reflexed, their margins straight and weakly declivent to the similar, faintly decurved, simple, socketed styles, which are nearly five times as long as their basal width, median portion of margin very weakly convex, without nodes

Head ochraceous buff with a tawny tinge, immaculate except for a broad interocular bar of blackish chestnut brown Antennae in greater portion blackish brown Ocelli ochraceous buff Limbs buffy, the ventral femoral margins weakly suffused and flecks at bases of tibial spines of brown Exposed portions of trochanters and ventral surface of abdomen blackish brown, dorsal surface of abdomen slightly paler Pronotum immaculate, disk dull ochraceous orange Tegmina and wings as described for *binodosa*

Two paratypic males, one from Nouveau Chantier taken in January, the other from St Jean du Maroni, French Guiana, are before us The measurements of the larger follow those of the male type Length of body 15 5, length of pronotum 4 1 to 4 4, width of pronotum 6 9 to 5 9, length of tegmen 16 8 to 16 8, width of tegmen 5 2 to 5 2 mm

Neoblattella longior new species. Plate XIV, figures 1 and 2

This species, like *N unifascia*, described on page 166, is small for the group, with very simple male genitalic specialization Its markings are few and vague, very much less distinct but of the general character of those found in *N binodosa*, described on page 165, while the interocular space is narrower even than in *N poecilops*, described on page 164

The female has tegmina and wings even more elongate than the male

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no. 1004]

Size rather small for this group of large species, form slightly more slender than in *unifascia* Interocular space very narrow for the group, one-quarter width between antennal sockets and one-third vertical depth of dorsal portion of eye. Ocellar spots, maxillary palpi, costal veins of wings, limb spination and tarsal claws as described for *poecilops* on page 164 Pronotum with point of greatest width slightly caudad of median line, where the convexity of the lateral margins is strongest and a trace of angulation is shown Tegmina and wings fully developed, very elongate for this group, the former with twelve discoidal sectors Dorsal surface of abdomen unspecialized. Supra-anal plate apparently similar to that of *unifascia* (distal portion destroyed) Subgenital plate with lateral portions reflexed, sinistral margin convex and dextral margin straight to the similar, socketed, straight, simple styles, which are nearly four times as long as their proximal width, median marginal portion narrowly curled dorsad, with margin very broadly and weakly convex

Allotype ♀, same data as type [Hebard Collection]

Agrees closely with the type except as follows Interocular space two-fifths width between antennal sockets Organs of flight even more elongate Supra-anal plate emarginate meso-distad to form an almost complete O, the curved lateral arms so formed slender with apices rounded Subgenital plate simple, lateral margins rather strongly convex, then very broadly and feebly concave below cerci, median portion weakly produced and rather broadly convex

General coloration light buckthorn brown, marked as follows Head with a broad band between the eyes and a narrow band between the buffy ocellar spots of cinnamon brown, these bands suffused and not at all conspicuous The more intensively colored female allotype has an even less conspicuous fleck on each side, between but near the antennal sockets, of brown Limbs with flecks of brown at the bases of the spines (except spines of the ventro-cephalic margin of the cephalic femora) Ventral surface of abdomen much as described for *binodosa* on page 165 In the recessive male type the brown suffusions are greatly reduced, laterad appearing only as a small dot on each sternite Disk of pronotum buckthorn brown with a tawny tinge, traces of the generic picturing indicated, particularly the five characteristic meso-caudal dots Tegmina and wings as described for *binodosa*

Length of body ♂ 15, ♀ 17 5, length of pronotum ♂ 3 9, ♀ 4 2, width of pronotum ♂ 5 2, ♀ 5.6, length of tegmen ♂ 17 8, ♀ 18 1, width of tegmen ♂ 5 2, ♀ 5 7 mm

This species is known only from the described pair.

THE NAHUA GROUP OF *Neoblattella*.

This group is now found to reach into South America at least as far as French Guiana. In this continent the number of species is apparently much less than those of the Adspersicollis Group.

Reëxamination of the tropical American series referred by us to *nahua*[48] shows that, though the general type of male genitalic specialization is similar, more than one species is represented. In our comparisons given below, we have, therefore, considered only Mexican material, representing true *nahua*

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[48] Mem. Amer Ent. Soc, No 4, p 64, (1919)

In the species of the Nahua Group the fifth andominal tergite is reflexed laterad in the male sex to form remarkable pockets on each side This is apparently the only feature which can be used to separate them from those of the closely allied Adspersicollis Group, in which the male abdomen has the dorsal surface unspecialized or with only a small median specialized area on the sixth and seventh abdominal tergites

Neoblattella incompta new species Plate XIV, figure 3

This species, though closely related to the Mexican *N nahua* (Saussure and Zehntner), may be separated by its larger size, much broader interocular space, more ample pronotum and larger lateral pockets of the male fifth abdominal tergite In the unique specimen before us the supra-anal and subgenital plates have been injured, but can be seen to be of a very similar type

The pronotal picturing, reduced to a number of suffused dots in *nahua*, is indicated only by a pair of suffused dots caudad in *incompta*

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1005]

Size large and form broad Interocular space slightly over three-fifths as wide as that between antennal sockets[46] Ocellar spots distinct Maxillary palpi with fourth joint slightly shorter than third, fifth three-quarters as long as fourth Pronotum with lateral portions broad, convexity of lateral margins strongest and point of greatest width slightly caudad of median line Tegmina and wings fully developed, ample, the former with (thirteen) longitudinal discoidal sectors, the latter with costal veins not clubbed distad Dorsal surface of abdomen with lateral portions of fifth tergite strongly reflexed and forming a longitudinal pocket on each side, the dorsal flap of which, at its widest point, is two-fifths as wide as its length, its internal free margin convex Sixth tergite and supra-anal plate damaged. Subgenital plate with lateral margins feebly reflexed, broadly convex declivent to the socketed, similar, simple styles, which proximad are weakly bent ventrad and are slightly less than four times as long as broad Cephalic femora with ventro-cephalic margin armed with a series of spines which decrease gradually in size and length distad, a few of the more distal being chaetiform, terminating in three elongate distal spines, ventro-caudal margin armed with five large, well separated spines. Pulvilli present on four tarsal joints, these and the arolia well developed Tarsal claws symmetrical, with prominent flanges decidedly toothed.

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[46] In a male of *nahua* from Cordoba, Mexico, the interocular space is very slightly over one-quarter as wide as that between the antennal sockets The interocular and interocellar bars are present, but below them there are only two suffused dots of dark brown on each side, one above the other

General coloration light buckthorn brown with a faint tawny tinge Head showing exactly the same color pattern as described for *N binodosa* on page 166, except that one of the three flecks on each cheek is missing while the other markings are all very weak, suffused, and none deeper than cinnamon brown Limbs and ventral surface buffy, the former with very small flecks of brown at the bases of the spines except on the ventro-cephalic margin of the cephalic femora Ventral surface of abdomen with a very large meso-proximal area of blackish brown and a narrow submarginal suffused band of prouts brown Disk of pronotum light buckthorn brown tinged with tawny, a pair of small subobsolete flecks of slightly darker brown meso-caudad Tegmina and wings as described for *binodosa*

The male type measures, length of body 16 1, length of pronotum 4 7, width of pronotum 6 1, length of tegmen 19 2, width of tegmen 5 7 mm

The measurements of a male of *nahua*, from Cordoba, Mexico, are, length of body 14 8, length of pronotum 3 9, width of pronotum 5 3, length of tegmen 18 9, width of tegmen 5 5 mm

Neoblattella aristonice new species. Plate XIV, figures 4 to 6, plate XVII, figure 14

Closely related to *N. nahua* (Saussure and Zehntner), described from Mexico, this species is distinguished by the less ample pronotum (that of the female being no larger than that of the male of *nahua*), the fewer and more suffused flecks of the pronotal disk (this feature probably individually somewhat variable) and the slightly less ample tegmina In the male, the hirsute proximal abdominal tergites, more simple supra-anal plate and less produced subgenital plate, serve to separate this sex with ease In the female the supra-anal plate has a deep apical emargination, nearly O-shaped, with curved lateral arms nearly attingent at their apices, while in that sex of *nahua* this emargination is smaller and almost quadrate

These two species are readily separated from *N incompta*, described on page 169, by the features of difference there given.

Type· ♂, Charvein, lower Maroni River, French Guiana. September. [Hebard Collection, Type no. 1006]

Size medium and form rather slender for this group of large and broad species Interocular space very slightly over one-quarter width between antennal sockets Maxillary palpi and cephalic limbs missing Pronotum with convexity strongest and point of greatest width meso-caudad Tegmina and wings fully developed, the former showing distad traces of minute nodes, which are not darkened Wings with costal veins not clubbed Median segment caudad and first five abdominal tergites thickly supplied with somewhat kinky, whitish hairs Fifth tergite with lateral pockets produced, oblique, the reflexed flaps on each side partially covering a rather broad concavity of the tergite, in which is situated a transverse, ovate lobe, these portions without hairs Supra-anal plate moderately produced between the cerci, subchitinous distad with only a trace of bilobation Subgenital plate symmetrical, brief lateral margins strongly declivent to the similar, simple, straight styles, which are scarcely four times as long as the basal width, intervening distal portion of plate weakly chitinous, its margin broadly convex

Allotype ♀, Nouveau Chantier, French Guiana August [Hebard Collection]

Agrees closely with male, except as follows Size slightly larger, form slightly broader, tegmina and wings more caudate Interocular space one-half width between antennal sockets Tegmina with the minute colorless nodes distad more prominent Dorsal surface of abdomen smooth and unspecialized Supra-anal plate emarginate meso-distad to form an almost complete O, the curved lateral arms thus formed slender with apices rounded, as in *N longior* here described

General coloration light buckthorn brown Head discolored, a small suffused fleck of dark brown, ventro-mesad of the antennal sockets on each side, alone being conspicuous Limbs buffy with small but decided flecks of dark brown at bases of spines, dorsal surfaces of femora suffused with brown; very feebly in male, decidedly in female (which individual is distinctly more intensive in general coloration) Disk of pronotum with generic picturing reduced to a number of suffused flecks, the five meso-caudad being distinct

These flecks are more numerous but in less contrast with the ground color than in the male of *nahua* before us, in which there are but two meso-caudal flecks The degree of individual variation due to recession and intensification of color pattern is, however, not known for the group It is probable we believe, that some specific value may, in the present case, be attached, as seven specimens of a related species from Panama before us show marked uniformity in number and position of such flecks

Length of body ♂ 13 5, ♀ (if in normal position) 15 5, length of pronotum ♂ 3.4, ♀ 4, width of pronotum ♂ 4 9, ♀ 5 3, length of tegmen ♂ 16 1, ♀ 16 9, width of tegmen ♂ 4 9, ♀ 5 mm

The species is known from the described pair Though *aristonice* is referable to the Nahua Group and *longior* belongs to the Adspersicollis Group, these two species are extremely similar, except for the very great differences in the specialization of the male abdomen and lesser differences in size and both length and structure of the organs of flight

Neoblattella callosoma new species Plate XIV, figures 7 and 8

We refer this species and its allies to what we term the Eudromielloides Group The two broad dark longitudinal bars on the pronotum and bicolored tegmina distinguish it, *N berlandi* Hebard (from the upper Amazonian region between Peru and Bolivia) and *N. eudromielloides* Hebard (from Minas-Geraes, Brazil), strikingly from all other known forms of the genus The male genitalia of *callosoma* are, though symmetrical, of a different type and very distinctive, but the species is clearly referable to the Eudromielloides Group

From the allies noted above, it is further distinguished by the much narrower interocular space, smaller size and distinctive features in the striking head and tegminal coloration

In the Brazilian *N fasciata* (Brunner) the tegmina are similarly bicolored, but the pronotal disk shows the picturing usual for this genus

The general similarity of coloration in this species and its allies to species of *Eudromiella* Hebard is noteworthy, considering the very wide structural differences between these genera

Type. ♂, Nouveau Chantier, French Guiana September [Hebard Collection, Type no 1007]

Size very small and form slender for the genus Eyes large and prominent, interocular space one-third width between antennal sockets Ocellar spots distinct, surfaces weakly oblique to the flattened intervening area and rounding into it Lateral margins of face subparallel to the clypeal suture Pronotum feebly convex to the lateral portions, showing broad and shallow but distinct latero-caudal depressions of the disk; point of greatest width slightly caudad of median line, lateral margins convex, caudal margin very broadly convex Tegmina and wings fully developed, extending well beyond cercal apices Tegmina with (seven) longitudinal discoidal sectors, these with intervening ridges and numerous cross-veinlets Wings with intercalated triangle large, apices of (nine) costal veins heavily clubbed, discoidal vein with (three) complete branches Supra-anal plate simple, moderately produced between cerci, with margins convergent and apex broadly and weakly bilobate Subgenital plate with free margin almost evenly convex, but seen to have a rather deep longitudinal cleft on each side of the median section, that portion so outlined broader than long, surface of plate convex except about these clefts, where it is concave narrowly along free margin of that area, structure less strongly chitinous in meso-distal section From below apex of these clefts are seen the minute, aciculate extremities of the similar styles, which spring from the internal surface of the plate (probably at the bases of the clefts), are spiniform and directed caudad are curved weakly ventro-caudad Ventro-cephalic margin of cephalic femora armed with delicate spines, which decrease gradually in length and size distad, terminating in two elongate spines, of which the more distal is much the longer, ventro-caudal margin armed with two delicate spines[47] Acute pulvilli present on four tarsal joints Arolia moderately large Tarsal claws symmetrical, with flange well developed bearing microscopic but unusually decided teeth, the last tooth, however, not half as large as the point of the claw (as it is in *eudromielloides* and *berlandi*)

Allotype ♀, Bartica, British Guiana March 26, 1913 (H S Parish) [Acad Nat Sci Phila]

Agrees closely with male, differing as follows Size slightly larger, form slightly more robust Interocular space slightly less than half width between antennal sockets Supra-anal plate one-third as long as its proximal width, lateral margins weakly oblique and very weakly convex, meso-distad with a small emargination, the lateral apices rounded Subgenital plate simple, lateral margins strongly convex, then very broadly concave below cerci, the median portion strongly produced with apex truncate

Head ochraceous buff, sharply marked with blackish chestnut brown as follows a very wide interocular bar, a narrow arcuate bar between the lower portions of the ocellar spots, another similar but wider bar between the lower portions of the antennal sockets continued across the face below them and then vertically margining the face laterad and a series of suffusions suggesting a transverse bar above the clypeal suture, the base of the occiput below the pronotum is also suffused Pronotum laterad transparent faintly tinged with buffy, there are two broad longitudinal bands of blackish brown which are briefly separated cephalad and gradually widen and diverge caudad, near the caudal margin almost joined by a transverse suffusion of chestnut brown, the area between these bands ochraceous buff Tegmina transparent russet but with marginal field and more than outer half of scapular field to near its apex transparent faintly tinged with buffy, veins of anal field and proximal portion of discoidal field strikingly whitish Wings rather heavily tinged with mummy brown, the area of the enlarged portion of the costal veins buffy Limbs clay color, suffused with brown. Ventral surface of abdomen clay color suffused with dull chestnut brown laterad and mesad, the lateral margins of the sternites buffy, the subgenital plate dull chestnut brown except the depressed areas which are paler

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[47] This is true also for *fasciata* and probably for all the species of the Eudromielloides Group, but in all other species of *Neoblattella* Shelford, as far as we have been able to determine, the number of such spines is three or more. In *Cariblatta* Hebard, two such spines are present In all other features, however, the species under consideration are referable to *Neoblattella* rather than to *Cariblatta*.

In the allotypic female all of the pale areas are slightly more extensive, the narrow facial bars interrupted and suffused, the pale veins proximad on the tegmina more broadly so, this covering the intervening area between the ulnar and median veins for a brief distance opposite the apex of the anal field Such difference we believe attributable to individual variation rather than to specific differentiation

The measurements of the described pair are length of body ♂ 9, ♀ 10 8, length of pronotum ♂ 2 1, ♀ 2 3, width of pronotum ♂ 2 8, ♀ 3 2, length of tegmen ♂ 9 9, ♀ 10 7, width of tegmen ♂ 2 8, ♀ 3.1 mm

A paratypic male, bearing the same data as the allotype of this unusually colored species, is also before us

ARAWAKINA new genus

We propose this genus to include a single small, pale species, which in the majority of features agrees with the genus *Neoblattella* Shelford It differs signally, however, in having a sharp ridge developed between the ocellar spots, the tarsal claws have a weak, untoothed flange and the male subgenital plate entirely lacks styles

Further characters of generic importance are the following Size small for the group, form slender, structure very delicate Interocular space wide, flattened to the interocellar ridge Sides of cheeks very feebly convergent below eyes Pronotum decidedly flattened Tegmina and wings fully developed in male, discoidal sectors of the former longitudinal Wings with costal veins heavily clubbed, intercalated triangle distinct Dorsal surface of abdomen unspecialized Male subgenital plate without styles Ventro-cephalic margin of cephalic femora armed with delicate spines which decrease gradually in size distad, terminating in two much longer spines, ventro-caudal margin armed with (three and one distal) spines Four proximal tarsal joints supplied with pulvilli Moderately large arolia present. The symmetrical tarsal claws have a poorly developed flange which lacks teeth

Arawakina frontalis new species. Plate XIV, figures 9 and 10.

The rounded interocular ridge, characteristic of *Lophometopum* Hebard, is not to be confused with the sharp interocellar ridge in the present insect

We know of no form showing affinity to this interesting and remarkably specialized species

Type ♂, Bartica, British Guiana December 27, 1912 (H S Parish) [Acad Nat Sci Phila , Type no 5425]

We note the following characters, in addition to those given in the generic description Size and form somewhat suggesting species of the genus *Blattella* Caudell Interocular space slightly narrower than that between the antennal sockets Ocellar spots distinct Maxillary palpi with third joint considerably longer than fourth, fourth longer than fifth Pronotum with lateral margins very evenly convex, greatest width meso-caudad Tegmina and wings fully developed, extending slightly beyond the elongate, slender cerci Tegmina with (five) longitudinal discoidal sectors, discoidal field with a number of colorless nodes on the veins Supra-anal plate strongly transverse, exposed portion about one-fourth as long as wide, free margin broadly rounded with lateral portions flattened Subgenital plate delicate, produced, rounding laterad into the nearly vertical lateral portions, distad with free margin transverse, feebly concave, lateral free dorsal margins narrowly curled inward throughout Styles absent

General coloration ochraceous buff with a decided tawny tinge Occiput deepening to ochraceous tawny Eyes mummy brown Antennae buckthorn brown Limbs ochraceous buff Lateral margins of pronotum, marginal field and portion of dextral tegmen concealed when at rest and wings hyaline, with a very faint buffy tinge, the latter with a slightly stronger tinge of buffy distad and in area of costal veins

The measurements of the type are followed by those of a paratypic male from the same locality, those from French Guiana being about the same size Length of body 10 and 10 9,[48] length of pronotum 2 6 and 2 7, width of pronotum 3 2 and 3 2, length of tegmen 10 4 and 10.6, width of tegmen 3 1 and 3 1 mm

Specimens Examined · 4 males

Bartica, British Guiana, December 10 and 27, 1912, (H S Parish), 2 ♂, *type* and *paratype*, [Acad Nat Sci Phila].

Nouveau Chantier, French Guiana, February, 2 ♂.

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[48] Abdomen squeezed out.

Leuropeltis atopa Hebard

1921 *Leuropeltis atopa* Hebard, Proc Acad Nat Sci Phila., 1921, p 200, pl X, figs 11 to 13 [♂, Gourdonville, French Guiana]

Charvein, lower Maroni River, French Guiana, August, 1 ♂

The discovery of the female of this very handsome and unusual species is awaited with interest

Ischnoptera stygia new species. Plate XIV, figures 16 and 17

This insect is very closely related to *I atrata* Hebard, from the Island of Trinidad The male sex is separable only by genitalic characters, the supra-anal plate having the chitinous portions laterad of the subchitinous mesodistal area narrow and not enlarging toward their apices The subgenital plate is similar except that the median projection is broader at its truncate apex, so that the surmounting dextral style only occupies its dextral half

With the Colombian *I morio* Burmeister, these species represent the known forms of the Morio Group

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1008]

Size very large for the genus, form moderately slender Ocellar spots large, with flattened surfaces of ocellar areas forming a sharp angle with interocellar area Interocular space very slightly narrower than interocellar space, two-fifths width between antennal sockets Maxillary palpi short, third and fifth joints subequal in length, the fourth joint distinctly shorter Pronotum with greatest width caudad, latero-caudal sulci of disk large but shallow Tegmina and wings fully developed, extending considerably beyond apices of cerci, portion of dextral tegmen, concealed when at rest, sub-hyaline Eighth tergite very broadly and evenly concave Supra-anal plate with a large, meso-distal, rounded-quadrate subchitinous portion, the remaining narrow lateral chitinous portions gradually narrowing distad; lateral margins moderately convergent, rounding into the transverse distal margin, which shows very broad and feebly rounded obtuse-angulate emargination Subgenital plate strongly asymmetrical, produced, with free margin dextrad broadly convex and nearly transverse to median point, there directed sinistro-caudad and forming a rounded obtuse-angulate emargination; apex of production thus formed truncate, half occupied by a moderately stout style, which is bent sinistrad with apex covered with minute spines, sinistral margin straight oblique to base of median production, the small, simple, straight sinistral style located at the point; sinistral margin of production directed dextro-caudad, forming with the sinistral margin a rounded angle even more obtuse than that dextrad. Tegminal and wing venation, specialisation of sixth and seventh abdominal tergites, armament of limbs and arolia as characteristic of the genus[49] Large rounded pulvilli present on four tarsal joints Tarsal claws simple and symmetrical.

Allotype ♀, Kartabo, Bartica District, British Guiana (Wm Beebe) [Acad Nat Sci Phila]

Agrees very closely with male in size and form, the latter, as usual in this sex, broader in the abdominal region Interocular space slightly over three-fifths width between antennal sockets, slightly wider than width between the large ocelli, which are, however, less sharply defined in contour Dorsal surface of abdomen not specialized, as is characteristic of this sex Supra-anal plate triangularly produced with sides showing faint concavity and apex rounded (truncate in one specimen) Subgenital plate ample, free margin broadly convex, showing flattening below cerci

Head, pronotum, all but distal portions of trochanters and abdomen blackish chestnut brown Antennae dark prouts brown, the first joint tawny Tegmina blackish chestnut brown, portion of dextral tegmen, concealed when at rest, hyaline but weakly embrowned, marginal field narrowly tawny toward the free margin Wings colorless, transparent, but with the veins brown Limbs clear ochraceous tawny

The measurements of paratypes follow those of the type and allotype Length of body ♂ 19 and 18 3, ♀ 19 5 to 18, length of pronotum ♂ 4 8 and 4 9, ♀ 5 3 to 5 2, width of pronotum ♂ 6 1 and 6 1, ♀ 6 4 to 6 7, length of tegmen ♂ 22 and 19 8, ♀ 20 7 to 21; width of tegmen ♂ 5 8 and 5 7, ♀ 5 8 to 5 8 mm

Specimens Examined 6, 3 males and 3 females

Kartabo, Bartica District, British Guiana, (Wm Beebe), 1 ♂, 3 ♀, *paratypes*, [Acad Nat Sci Phila]

Chenapowu to Saveritik, British Guiana, August 21, 1911, 1 ♂,[50] [Amer Mus Nat Hist]

St. Jean du Maroni, French Guiana, 1 ♂, *type*

Ischnoptera rehni[51] new species. Plate XV, figures 1 to 3.

This is one of the larger forms of the many small species of *Ischnoptera*. It is very closely related to *I clavator* Rehn, described from Igarapé-Assú, Pará, Brazil, but is separated by the very different male genitalic specialization

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[49] As described in Trans. Amer Ent Soc, XLII, p 338, (1916)

[50] This specimen, which lacks its abdomen, was originally recorded by us as *atrata*. Trans. Amer Ent Soc, XLII, p 343, (1916) We are now satisfied that it represents *stygia* and not that species

[51] Named in honor of our friend and fellow worker, Mr James A. G Rehn, whose studies in the Orthoptera of South America are already very extensive and valuable.

In other features the agreement is so close that females are almost inseparable, those of *clavator* having the interocular space averaging very slightly narrower and the supra-anal plate slightly broader distad

In a number of related species before us, the female supra-anal plate shows striking specific differentiation

Type ♂, St Laurent du Maroni, French Guiana February [Hebard Collection, Type no 1009]

Size small, but large for the small species of the genus, form slender Ocellar spots large, with flattened surfaces forming a sharp angle with interocellar area Interocular space two-fifths width between antennal sockets, two-thirds width between ocellar spots, slightly wider than in *clavator* Maxillary palpi with fifth joint subequal in length to third, fourth distinctly shorter, the last two joints hirsute, as in *clavator*. Pronotum with greatest width caudad, latero-caudal sulci of disk large and prominent Tegmina and wings fully developed, extending considerably beyond cercal apices Supra-anal plate moderately produced between cerci, distad sub-bilobate, the ventral surface distad supplied with a fringe of chaetiform spines and dextrad with a very small tuft of longer chaetiform spines, but nowhere highly specialized Concealed genitalia dextrad showing a plate, which distad is enlarged and has its margin rounded and supplied with minute spines, sinistrad showing a large plate which narrows and curves dorsad to an acute apex, below its base there is a very small styliform projection armed at apex with a few spines Subgenital plate laterad narrowly curled inward beneath cerci, these areas armed with very minute spines, distad irregularly produced, a small slender sinistral style[52] in broadly concave sinistral section, a shorter but stout small dextral style at point of greatest production, the margin between these weakly oblique and convex, internal surface with median produced portion raised, rounded conical and supplied with small spines [53] Tegminal and wing venation, specialization of sixth and seventh abdominal tergite, armament of limbs and arolia as characteristic of the genus [54] Pulvilli and tarsal claws as here described for *I stygia*

Allotype. ♀, St Jean du Maroni, French Guiana. [Hebard Collection]

Agrees closely with male, except as follows Interocular space three-fifths width between antennal sockets, slightly wider than in this sex of *clavator*. Dorsal surface of abdomen unspecialized

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[52] This style differs in length and shape in each of the three males before us.

[53] In a male from British Guiana all of the specialized areas and spines are slightly more pronounced

[54] See page 177, footnote 49.

Supra-anal plate moderately produced between cerci, lateral margin converging to the broadly rounded apex[55] In dorsal aspect no emargination occurs in this species (or in *clavator*), though in caudal aspect the supra-anal plate is seen to be tectate, appearing to have a broad V-emargination at its apex In a narrow V-shaped area there, this plate is less chitinous than elsewhere, but in no specimens of this species or *clavator* can it be said to be actually V-emarginate as originally described for *clavator*[56] Subgenital plate large, free margin broadly and evenly convex

Head blackish chestnut brown paling dorsad, ocellar spots pale ochraceous buff, mouthparts and palpi ochraceous buff tinged with brown Antennae dresden brown Bases of trochanters and abdomen dark chestnut brown Remaining portions of limbs clear ochraceous buff Pronotum chestnut brown, margined narrowly cephalad and more broadly laterad with ochraceous-buff, this briefly invading the dark area meso-caudad In one paratype a diffused medio-longitudinal tawny streak appears on the pronotum Tegmina transparent cinnamon brown, becoming opaque mars brown along the humeral trunk and paling toward the tegminal apices, marginal field narrow, ochraceous buff

The measurements of the type and allotype are given first for the sexes, followed by the extremes among the paratypes Length of body ♂ 11 7 and 11 7, ♀ 10 8 to 10 8, length of pronotum ♂ 2 8 and 2 8, ♀ 2 9 to 2 9, width of pronotum ♂ 3 7 and 3 7, ♀ 3 8 to 3 7, length of tegmen ♂ 12 4 and 11 7, ♀ 12 to 11 4, width of tegmen ♂ 3 7 and 3 7, ♀ 3 7 to 3 7 mm

Specimens Examined 15, 3 males, 11 females and 1 immature individual

Bartica, British Guiana, May 7, 1901, (R J Crew), 1 ♀,[57] December 24, 1912 to March 10, 1913, (H S Parish), 3 ♀, [all Acad. Nat Sci Phila]

Kartabo, Bartica District, British Guiana, (Wm Beebe), 3 ♀, [Acad Nat Sci Phila]

Tumatumari, British Guiana, 1913, 1 ♂, [Amer Mus Nat Hist]

St. Jean du Maroni, French Guiana, 4 ♀, *allotype* and *paratypes*, 1 juv ♀

St Laurent du Maroni, French Guiana, 1 ♂, *type*

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[55] In *clavator* the female supra-anal plate is very similar, the margins less convergent and slightly more convex distad, so that the apex is slightly more broadly rounded

[56] See Rehn, Proc. Acad Nat Sci Phila., 1918, p 155, (1918).

[57] Recorded by Rehn as *I rubiginosa* Walker, Trans. Amer. Ent Soc., XXIX, p. 264, (1903) That species apparently belongs to the same group as *rehni*.

Roches de Kourou, French Guiana, 1 ♂, *paratype*
La Forestière, French Guiana, June, 1 ♀, *paratype*
Nouveau Chantier, French Guiana, October, 2 ♀, *paratypes*

Ischoptera galibi[54] **new species Plate XV, figures 4 to 7**

The present species is very small, with blackish chestnut brown pronotum narrowly bordered cephalad and a little more widely laterad with buffy Similar in this respect, but differing widely in genitalic features, are several other related species in the unstudied collections before us Of the described species, *I rubiginosa* Walker, from Santarem, Brazil, apparently shows nearest affinity.

Type. ♂, Nouveau Chantier, French Guiana May [Hebard Collection, Type no 1010]

Size very small, form slender Ocellar spots prominent, surfaces oblique to the weakly convex interocellar area but rounding smoothly into it Interocular space wide, slightly over three-fifths width between antennal sockets, distinctly less than width between ocellar spots Maxillary palpi short, third joint three-quarters as long as fifth, fourth three-quarters as long as third Pronotum with greatest width caudad, latero-caudal sulci of disk subobsolete (varying to weak in the series) Tegmina and wings fully developed, extending beyond cerci fully the pronotal length Supra-anal plate well produced between cerci, lateral margins straight and convergent, rounding sharply into the rather broad, truncate caudal margin, surface, just before that margin, narrowly subchitinous Viewed from the side the lateral portions of the supra-anal plate are seen to be narrowly deflexed, and its ventral surface, just beyond the sinistral cercus, bears a large truncate cone, surmounted by a group of agglutinated, spiniform hairs Subgenital plate with lateral margins irregularly convex convergent to median portion, there the plate is suddenly briefly produced, an elongate similar style with apex aciculate at each extremity of this production, its margin between transverse in ventral aspect, but in caudal aspect seen to have a small narrowly triangular production, directed dorsad, situated just dextrad of the sinistral style Tegminal and wing venation, specialization of sixth and seventh abdominal tergites, armament of limbs, pulvilli, arolia and tarsal claws as characteristic of the genus.[55]

Allotype ♀, Nouveau Chantier, French Guiana February. [Hebard Collection]

Agrees closely with type, differing as follows Size larger, form slightly broader Interocular space wider, slightly less than width between ocellar spots Dorsal surface of abdomen unspecialized Supra-anal plate with free margins very strongly convergent to a brief distance within cerci, then rounded, shield-shaped produced, the rounded apex projecting well beyond the subgenital plate Subgenital plate simple, free margin evenly and very broadly convex

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[54] A tribe of Caribs, inhabiting part of the region in which this insect occurs.
[55] See page 177, footnote 49

The general coloration of this and other species is apparently of much value in determining group affinities in the present genus. Head blackish chestnut brown, ocellar spots light buff, mouthparts and palpi buffy, the latter with distal joints suffused with brown Antennae dresden brown, the first joint buffy dorsad Trochanters to near apices blackish brown, other portions of limbs ochraceous buff Ventral surface of abdomen russet, paler in some males, usually much darkened in females Pronotum shining blackish chestnut brown, margined very narrowly cephalad and slightly more widely laterad with rich ochraceous buff This marginal marking is sharply defined, though very narrow, and is an important group feature Tegmina transparent chestnut brown, the outer portions of the costal field ochraceous buff, this continued weakly along costal margin of scapular field, for a considerable distance in some specimens Wings strongly infumate

The series shows scarcely any size variation The measurements of the described pair are length of body ♂ 8, ♀ 8, length of pronotum ♂ 2 1, ♀ 2 3, width of pronotum ♂ 2 8, ♀ 3, length of tegmen ♂ 8 4, ♀ 8 7, width of tegmen ♂ 2 7, ♀ 2 7 mm

Specimens Examined. 18, 7 males and 11 females

Les Hattes, lower Maroni River, French Guiana, July, 1 ♀, *paratype*

St Laurent du Maroni, French Guiana, January, 1 ♂, *paratype*

St Jean du Maroni, French Guiana, January, February and December, 2 ♂, 4 ♀, *paratypes*

Nouveau Chantier, French Guiana, February, May and July, 2 ♂, 2 ♀, *type, allotype* and *paratypes*

Roches de Kourou, French Guiana, July, 1 ♂, *paratype*

La Forestière, upper Maroni River, French Guiana, February and July, 3 ♀, *paratypes*

Charvein, French Guiana, October and November, (R Benoist), 1 ♂, 1 ♀, *paratypes*

Ischoptera paramacca[66] new species Plate XV, figures 8 and 9

This insect is extremely close to the male, described as *I castanea*

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[66] The "Bush negroes" of French Guiana are known by this name

Saussure by Rehn[61] in 1918, from Igarapé-Assú, Pará, Brasil[62] Saussure's species, described from Brasil, is apparently larger, with more ample pronotum and longer tegmina That insect can not be definitely located, without comparison of the type with much more material of the group than at present can be assembled It is evident that Saussure, and later Saussure and Zehntner, in several cases recognized only species groups and not the actual number of species before them Thus Mexican material later recorded as *castanea*, as well as Cuban and Nicaraguan material recorded by them as the Brazilian *parvula*, is unquestionably referable to other species, showing only superficial similarity to those they were supposed to represent

The small size and solidly dark pronotum are striking features, making definite assignment of *paramacca* to the Castanea Group possible

Type ♂, St Jean du Maroni, French Guiana May [Hebard Collection, Type no 1011]

Size very small, though larger than *I galibi* here described, form slender Ocellar spots prominent, their surfaces oblique to the interocellar area and rounding rather suddenly into it Interocular space slightly less than two-thirds as wide as that between antennal sockets, slightly less than width between ocellar spots Maxillary palpi short, third and fifth joints subequal in length, fourth shorter Pronotum with greatest width meso-caudad, latero-caudal sulci of disk large and broad, conspicuous but not deep Tegmina and wings fully developed, extending beyond cercal apices a brief distance Supra-anal plate produced between cerci, with straight and convergent lateral margins rounding into the rather narrowly truncate apex, lateral marginal portions narrowly deflexed and seen to be thickened in caudal aspect, giving a somewhat bilobate appearance to the apex of the plate, these lobes ventrad supplied with a fringe of spiniform hairs Ventral surface of supra-anal plate produced in a large conical process just beyond base of sinistral style, this process tipped with a tuft of spiniform hairs. Subgenital plate weakly asymmetrical, with dextral, sinistral and median emarginations, between which are short truncate projections; sinistral emargination much broader than the dextral, each forming a rounded rectangulation at the external bases of the projections, median emargination feebly concave Styles similar, but the sinistral nearly twice the size of the dextral, cylindrical, tapering and decurved distad to the acute apex [63] Tegminal and wing venation, specialization of sixth and seventh abdominal tergites, armament of limbs, pulvilli, arolia and tarsal claws as characteristic of the genus [64]

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[61] Proc Acad Nat Sci. Phila , 1918, p 149, pl. I, figs. 13 and 14.

[62] In that male the lateral margins of the supra-anal plate are less thickened, the apex wider and the ventral surface has the production proximad and adjacent to the base of the sinistral cercus. These appear to be the only noteworthy differences from *paramacca*. Should they prove to be due to individual variation, it would necessitate referring the Pará specimen to the present species, until the exact status of *castanea* can be determined.

Allotype ♀, St Jean du Maroni, French Guiana [Hebard Collection]

Agrees closely with male, differing as follows Size slightly larger, form slightly broader Interocular space wider, slightly less than width between ocellar spots Dorsal surface of abdomen not specialized Supra-anal plate with margins broadly concave convergent, rounding evenly into the rounded apex Subgenital plate simple, free margin evenly and very broadly convex

Coloration of head, antennae, palpi, limbs and ventral surface as described for *I galibi* on page 181 Pronotum solidly shining blackish chestnut brown, the immediate margins appearing slightly paler under the lens Tegmina transparent chestnut brown, the marginal portion of the costal field alone ochraceous-buff Wings strongly infumate

The measurements of the type and allotype are followed by those of the extremes of the series [65] Length of body ♂ 10 to 10 6, ♀ 9 8 to 10 1, length of pronotum ♂ 2 4 to 2 7, ♀ 2 6 to 2 6, width of pronotum ♂ 3 1 to 3 5, ♀ 3 3 to 3 2, length of tegmen ♂ 9 9 to 10 4, ♀ 9 8 to 10 1, width of tegmen ♂ 3 to 3 2, ♀ 3 to 3 2 mm

Specimens Examined 22, 11 males and 11 females

Bartica, British Guiana, December 9, 1912 to March 19, 1913, (H S Parish), 4 ♂, 5 ♀, [Acad Nat Sci Phila]

Amatuk, British Guiana, August 14, 1911, (F E Lutz), 1 ♂, [Amer. Mus Nat Hist]

Kaiteur, British Guiana, July 29 to August 9, 1911, (F E Lutz), 3 ♀, [Amer Mus Nat Hist]

St Jean du Maroni, French Guiana, May and August, 2 ♂, 3 ♀, *type, allotype* and *paratypes*

Nouveau Chantier, French Guiana, October, 3 ♂, *paratypes*

Roches de Kourou, French Guiana, 1 ♂, *paratype*

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[63] The lobe described by Rehn at base of the dextral style in the Pará individual, referred to *castanea*, is part of the concealed genitalia and is not attached to the subgenital plate

[64] See page 177, footnote 49

[65] The measurements for the type of *castanea* are "Length of body 10, length of pronotum 3, width of pronotum 3 8, length of tegmen 11 mm "

Xestoblatta nyctiboroides (Rehn) Plate XV, figure 10

1906 *Ischnoptera nyctiboroides* Rehn, Proc Acad Nat Sci Phila., 1906, p 266 [♀, Demerara, British Guiana [66]]

Unfortunately, a male belonging to the Academy, from Igarapé-Assú, Pará, Brazil, was supposed by us to represent *nyctiboroides* and so described [67] It is now seen to represent a distinct species, very similarly colored but larger, with very distinctive male styles For that insect we now propose the name *Xestoblatta para*, the Academy type number being 5424

Nouveau Chantier, French Guiana, September, 1 ♂

This male agrees closely with the female type, except in being distinctly smaller Interocular space slightly less than that between the small ocellar spots, as in *para* Dorsal surface of abdomen hardly specialized median segment, and succeeding tergites to a decidedly less degree, with surfaces laterad supplied with minute tubercles, latero-caudal angles of tergites, except seventh, slightly acute-angulate produced. The truncate subgenital plate in dextral portion is produced dorsad, and from this small production extends along the margin of the plate sinistrad an elongate cylindrical process (the dextral style) which meso-distad is directed dorso-sinistrad to its slender apex, sinistrad at the point where the lateral margin of the plate curves into the distal margin is a longer process (the sinistral style) with a bulbous base, similarly lying dorsad along the distal margin of the plate and distad likewise directed dorso-dextrad to its slender apex, so that these distal portions cross

The color is that of the type female, except that the bases of the trochanters are less darkened This male measures as follows, length of body 15, length of pronotum 4 1, width of pronotum 5 7, length of tegmen 15, width of tegmen 4 8 mm

Xestoblatta castanea new species.

This handsome insect is readily distinguished from the seven previously described species by its very dark brown, immaculate coloration In size and form it is nearest *X sancta* (Giglio-Tos), but is probably representative of a very distinct phylum

Type. ♀, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1012]

Size large, form moderately broad for the genus Head with interocular space broad, widening gradually ventrad, least width 1 2 millimeters, narrower than that between the small ocellar spots,

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[66] This type is now in the author's collection, number 51

[67] Trans. Amer Ent Soc, XLII, p. 378, pl XIX, figs. 1 to 4, (1916) Later recorded by Rehn, Proc Acad Nat Sci. Phila, 1918, p 156, (1918).

Pronotum as characteristic of the genus, evenly and distinctly convex, greatest width meso-caudad, caudal margin very broadly angulato-convex mesad Tegmina and wings broad, reaching beyond the abdomen a distance equal to the pronotal length Sixth abdominal tergite with latero-caudal angles sharply acute at about thirty degrees, produced caudad, seventh and eighth very narrowly exposed, the former with a heavy rounded marginal projection on each side Supra-anal plate rotundato-trigonal produced between the cerci, length about two-fifths basal width, apex with a minute emargination suggested, the structure less strongly chitinous toward this point Subgenital plate very ample, simple, free margin broadly convex, flattened below cerci, distal portion very narrowly curled dorsad and briefly cleft mesad Limbs, their armament and arolia as characteristic of the genus[68] Four proximal tarsal joints supplied distad with rounded pulvilli Tarsal claws simple, symmetrical

General coloration shining blackish chestnut brown, deepest on head and pronotum Ocellar spots antimony yellow Antennae and palpi mummy brown, the proximal joints of the latter with buffy areas Tegmina and limbs showing the chestnut coloration more distinctly, due to their translucency Dorsal surface of abdomen with each tergite paling to russet narrowly and transversely, proximad on each side

The measurements of this unique female type are, length of body 19, length of pronotum 5 1, width of pronotum 6 9, length of tegmen 20 6, width of tegmen 6, length of caudal tibia 8 6 mm

GALIBIA[69] new genus

No genera in any way closely related to *Galibia* are known It appears advisable, however, to place it in the Pseudomopinae, following the Group Ischnopterae, as the wings show even more branches of the ulnar vein than are developed in the species of that group The high specialization of the male subgenital plate, different femoral spination, very large arolia and extremely asymmetrical, simple tarsal claws, show its wide separation from any of the genera of that group.

Compared with the Epilamprinae, the head and pronotal form shows considerable similarity to *Leurolestes* Rehn and Hebard, the wing venation being also largely the same, but the form of the organs of flight, tarsal claws and male genitalia is very different

Though the tarsal claws are asymmetrical, separation from the

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[68] Described Trans. Amer Ent Soc , XLII, p 373, (1916)

[69] The Galibis are a tribe of Carib stock, inhabiting the region in which this new genus and species was found

Nyctiborinae is clearly demonstrated by the slender antennae, absence of pile and general type of genitalia

The following characters, shown by the male sex, are of generic importance Size medium small compared with the Ischnopterae, form medium Head slightly wider than long, eyes moderately separated, ocellar areas poorly defined, palpi very short Antennae slender and longer than body Pronotum smooth and broadly convex, lateral portions rather narrow, caudal margin very broadly convex, almost truncate Tegmina and wings fully developed, the former with discoidal sectors weakly oblique Wings with costal veins somewhat thickened to near bases, ulnar vein with more incomplete than complete branches, intercalated triangle feebly indicated Abdomen with median segment specialized Supra-anal plate well produced mesad Subgenital plate symmetrical, highly specialized Cephalic femora with ventro-cephalic margin supplied with well-spaced, minute, chaetiform spines, terminating in two moderately heavy and moderately elongate distal spines, ventro-caudal margin supplied with one (or none) and one distal smaller spines Other ventral femoral margins well supplied with similar spines Four proximal tarsal joints with moderately large pulvilli, the caudal metatarsus with a double row of spines before its pulvillus Very large arolia present between the strongly asymmetrical, simple tarsal claws

Galibia insignis new species. Plate XV, figures 11 to 13

This tawny and ochraceous buff cockroach is not striking in general appearance, but shows a most unusual combination of characters

Type ♂, St Jean du Maroni, French Guiana. [Hebard Collection, Type no 1019]

In addition to the generic characters, the following are noted. Interocular space two-fifths width between antennal sockets. Ocellar spots large Maxillary palpi with third joint two-thirds as long as fifth, fourth enlarging strongly dorsad, three-fourths as long as third; fifth greatly enlarged Pronotum with greatest width mesocaudad. Tegmina and wings extending slightly beyond apices of cerci, anal field of former elongate Wings with area of costal veins opaque, median vein not forked Abdomen with median segment bearing mesad a large tuft of agglutinated hairs, seventh tergite narrowly visible; eighth well produced latero-caudad and there infolding bases of cerci Supra-anal plate with median portion produced, the sides of this production weakly convergent, its apex rather broadly rounded. Within anal chamber a cylindrical, chitinous projection springs from near base of sinistral cercus and curves to its acute apex; dextrad a homologous projection is seen to be heavier, shorter and somewhat lamellate. Subgenital plate symmetrical, lateral portions reflexed, distad suddenly deeply and roundly notched, in which concavities are the small, simple styles, between these styles the margin of the plate is produced dorsad and entirely filled by two rounded lobes, these with dorsal surface very thickly armed with delicate spines which are directed caudad

Head ochraceous buff Antennae, palpi, limbs and ventral surfice uniform, very dull orange buff Pronotum with disk deep ferruginous, other portions ochraceous buff, but the lateral portions transparent and only faintly tinged to near the disk Tegmina transparent, appearing weakly tinged with ochraceous tawny, with marginal field paler, under the lens seen to have a series of delicate dots and lines between the veins of ochraceous tawny, except distad and in marginal field Wings very faintly tinged with ochraceous tawny, the apex, marginal field and veins as much so as the tegmina, the area of the costal veins opaque and more buffy Remaining portions of dorsal surface and cerci dull orange buff

Two immature males and one immature female, from the same locality, are before us These are large and show a very different coloration from the adults, being hazel suffused with blackish laterad (faintly on the pronotum in one, the others having the pronotal disk solidly hazel) and mesad on abdomen, the dorsal segments all margined laterad and caudad with buff The head is blackish brown, paling toward hazel on the occiput

The measurements of a male paratype, bearing the same data, follow those of the male type Length of body 13 and 12 8, length of pronotum 3 1 and 3 1, width of pronotum 4 2 and 4 2, length of tegmen 12 8 and 12 6, width of tegmen 3 7 and 3 7 mm

Euphyllodromia literata (Burmeister)

1838 *Bl[atta] literata* Burmeister, Handb Ent , II, Abth II, pt I, p 497 [Surinam (= Dutch Guiana)]

We have established the synonymy of *Blatta alternans* Serville and *Pseudophyllodromia pavonacea* Rehn[70]

St Jean du Maroni, French Guiana, May and August, 4 ♂, 4 ♀

St Laurent du Maroni, French Guiana, October, 1 ♂

Nouveau Chantier, French Guiana, January, June, July, September and October, 4 ♂, 5 ♀

Charvein, lower Maroni River, French Guiana, September, 1 ♂, 1 ♀

Gourdonville, French Guiana, 3 ♀

We have previously reported this, one of the most abundant species of the genus in French Guiana, from La Forestière, on the upper Maroni River.

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[70] Proc Acad Nat Sci. Phila , 1921, p 201, (1921)

Additional material of the species has been received from Teffe and Flores, near Manaos, Amazonas, Brazil

Euphyllodromia elegans (Shelford)

1907 *Pseudophyllodromia elegans* Shelford, Ann Mag Nat Hist, (7), XIX, p 34 [[♀], Maroni [River], French Guiana]

Mallali, British Guiana, March 11, 1913, (H S Parish), 1 ♀, [Acad Nat Sci Phila]

Les Hattos, lower Maroni River, French Guiana, July, 1 ♀

St Jean du Maroni, French Guiana, January, August and December, 3 ♀

St Laurent du Maroni, French Guiana, January, 3 ♀

Charvein, lower Maroni River, French Guiana, August and September, 2 ♀

Nouveau Chantier, French Guiana, January, June, July and August, 1 ♂, 4 ♀

La Forestière, upper Maroni River, French Guiana, December, 1 ♀

A very closely related but distinct species, with narrower interocular space, more caudate organs of flight and much paler and more reddish general coloration, was recorded by us in 1921 as this species, from Pará, Brazil, and Cauca, Colombia The distribution of *elegans* reaches the upper Amazon, however, as is shown by specimens now before us from Teffe, Brazil, and Yurimaguas, Peru

The depth of coloration in this insect makes the pronotal disk and tegmina appear almost black, with markings buffy

In the male the styles are represented by a pair of large, rounded triangular, attingent plates

The extremes in the present series of topotypes measure as follows. length of body ♂ 9, ♀ 8 8 to 9 6, length of pronotum ♂ 2 8, ♀ 2 8 to 2 9, width of pronotum ♂ 3.8, ♀ 3 8 to 4; length of tegmen ♂ 10, ♀ 9 3 to 10 1, width of tegmen ♂ 2 9, ♀ 2 7 to 2 9 mm.

Euphyllodromia variegata (Walker)

1868. *Blatta variegata* Walker, Cat. Blatt British Mus., p 112 [♂, Pará, Brazil]

1872 *Ps[eudophyllodromia] lineolata* Saussure, Mélang. Orth , II, fasc 4, p. 99 [♂, Brazil]

The synonymy indicated above was first suggested by Rehn in 1916 Additional material in a large collection from Pará, Brazil and the adjacent regions, agrees in full with Walker's description, while no other species in any way similar are represented. Saussure's better description leaves no doubt that this was the species he described as *lineolata*

Les Hattes, lower Maroni River, French Guiana, August, 1 ♂

St Jean du Maroni, French Guiana, 1 ♀

St Laurent du Maroni, French Guiana, April, 1 small juv

Nouveau Chantier, French Guiana, July, 1 ♀, June and October, 2 large juv ♀

In the immature condition the two narrow, pale, meso-caudal, longitudinal bands of the pronotum are carried across the mesonotum and metanotum, while the first and fifth abdominal tergites are largely buffy The five pale vertical occipital lines, so distinct in the adults, are obsolete in the early stages

Euphyllodromia chopardi Hebard

1921 *Euphyllodromia chopardi* Hebard, Proc. Acad Nat Sci Phila, 1921, p 202, pl XV, figs 1 and 2 [♂, ♀ Bartica and Demerara, British Guiana, Gourdonville and Charvein, French Guiana]

St Jean du Maroni, French Guiana, 3 ♂, 1 ♀

Nouveau Chantier, French Guiana, October, 1 ♀.

Charvein, lower Maroni River, French Guiana, September, 1 ♀

We now have material before us showing that the distribution of this species reaches as far southwestward as Parintins and Oroximina on the Trombetas River, Brazil

Pseudomops oblongata (Linnaeus)

This species has been reported from French Guiana, but no material of it or any of its near allies is represented in the present collection.

Pseudomops luctuosa (Saussure)

1870. *Thyrsocera luctuosa* Saussure, Miss. Sci Mexique, Rech Zool, VI, p 48, pl I, figs 27 and 27*a* [♀, Surinam (= Dutch Guiana)]

We have carefully considered *P crinicornis* (Burmeister), described from Pará, Brazil, and find that *luctuosa* is exceedingly closely related Walker's description of a female from Pará, adds to the original data on that species the statement that the apical half of the antenna is whitish toward its base. In *luctuosa*, known only from females, the antennae are solidly black.

In all other described features these species appear to agree fully, but that difference is apparently so marked, that it seems unwise to place *luctuosa* as a synonym of *crinicornis*, as Kirby did in 1904

Unfortunately Saussure and Zehntner recorded material from

Cayenne as *crinicornis*[71] which actually represents *P. affinis* (Burmeister), at that time wholly ignoring *luctuosa* That incorrect determination was accepted by Shelford in 1906,[72] who consequently stated that *luctuosa* was quite distinct from *crinicornis* (the comparison being actually made with material of *affinis*)

Demerara, British Guiana, 1901, (R J Crew), 1 ♀ [73]

St Jean du Maroni, French Guiana, February and June, 2 ♀

These specimens agree in every way with each other and with a female from Iquitos, Loreto, Peru,[74] the solid black coloration strikingly marked with whitish buff being exactly as excellently figured in color by Saussure

Our attitude that *luctuosa* from the Guianas and upper Amazon probably represents a distinct, though closely related, species from *crinicornis* from Pará, Brazil, is strengthened by the fact that, when similar forms of the rarer Blattidae occur in these two regions, they are specifically separable in many cases

Pseudomops affinis (Burmeister)

1838. *Th[yrsocera] affinis* Burmeister, Handb Ent, II, Anch II, pt I, p 499. [Surinam (= Dutch Guiana)]

There is no doubt but that the material recorded by Saussure and Zehntner from Cayenne[75] represents this species Brazil was also given by them, that record based on the specimen twice previously correctly recorded by Saussure The male, recorded and described as *affinis* by Walker, from "St. Paul" Brazil, may represent it or a closely allied species Rehn's record of *affinis* from Igarapé-Assú, Pará, Brasil, represents a distinct species, allied to *affinis* but probably nearer *P hirticornis* (Burmesiter),[76] described from Pará

St Jean du Maroni, French Guiana, February, 1 ♀

La Forestière, upper Maroni River, French Guiana, December, 1 ♀

In one specimen the narrow buffy margins of the pronotum invade the disk in a large triangular area meso-caudad on each side, in the other this invasion is very weakly indicated, being as large but greatly darkened In both the cephalic margin of the pronotum is briefly and very narrowly margined with buffy The caudal portion of the pronotum is narrowly margined with buffy, but the immediate margin is black The tegmina are very different from those of *P luctuosa* (Saussure), the mediastine field, median portion of the anal field and an area along the discoidal vein being transparent, very faintly tinged with buff That species has the anal field solidly black and opaque, the other homologous markings buffy and very feebly translucent

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[71] Biol Cent-Amer, Orth, I, p. 33, (1893)

[72] Trans. Ent. Soc London, 1906, p 261

[73] Recorded by Rehn in 1906, as *P crinicornis* (Burmeister) The male recorded at the same time, we believe, represents a distinct species.

[74] That specimen unfortunately lacks the distal portions of the antennae.

[75] Biol. Cent.-Amer, Orth, I, p 33, (1893)

[76] That name was placed as a synonym of *affinis* by Brunner in 1865. We believe that it represents a Brasilian species, allied to but distinct from the Guianan *affinis* Kirby recognized *hirticornis* as valid in 1904, but Shelford followed Brunner in 1906, disregarding the indications that that author had discussed material as *affinis* which probably represented two species.

The present species is also smaller, the total length to the tips of the tegmina in these females being 11 9 to 12 8 mm , while in the Guianan females of *luctuosa* before us it is 14, 15 and 15 8 mm

BLATTINAE

Pelmatosilpha guianae new species Plate XV, figure 14

This unicolorous species, with polished coriaceous tegmina reaching almost the apex of the abdomen, is nearest the Brazilian *P alaris* (Saussure) and the Panamanian *P rotundata* Scudder [77]

From the former it may be separated by the immaculate head and pronotum and distinctive supra-anal plate of the male. In other features it agrees with *alaris* and not *rotundata*, that species having the dorsal surface more convex and the cerci much shorter, not surpassing the supra-anal plate

In size these species agree closely, the tegmina of *guianae* being slightly longer, the degree probably insufficient to use this feature as specifically diagnostic

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1016]

Size large for the genus, though greatly exceeded by the upper Amazonian *P. praestans* Dohrn,[78] form broad Head smooth, face very feebly convex Interocular space very broad, slightly wider than width between antennal sockets Ocellar spots small, distinctly defined in color only Pronotum weakly convex, showing a very feeble triangular impression meso-caudad, flanked by very feeble rounded impressions, greatest width toward caudal margin, which is very broadly and evenly convex Tegmina extending slightly beyond base of supra-anal plate, with apices broadly rounded, surfaces coriaceous, smooth and polished, very feebly convex, veins apparent only in marginal and distal portion of discoidal field, anal sulcus distinct only in distal third Wings extending as far caudad as tegmina Abdomen with latero-caudal angles of tergites aciculate produced, this production gradually increasing caudad to sixth, where it is large Supra-anal plate strongly produced between cerci with margins there straight and convergent to the decidedly bilobate and rather narrow apex, lateral margins narrowly reflexed with dorsal surface sloping faintly dorsad to a weak medio-longitudinal ridge [78] Subgenital plate symmetrical, strongly emarginate at the base of the similar, straight, slender, elongate styles; median portion between these somewhat produced, broadly and moderately bilobate Limb spination heavy Caudal metatarsus slightly longer than combined length of the three succeeding joints Pulvilli and arolia large Tarsal claws heavy, simple, symmetrical

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[77] Described from Panama and Texas, we believe that the latter record is based on an adventive specimen

[78] The fourth South American species known, *P convexa* Shelford, is much smaller than *guianae* It was described from Espiritu Santo, Brazil, in 1910

General coloration shining black with a chestnut tinge Ocellar spots buffy Second and third abdominal tergites with a transverse submarginal suffusion of buff tinged with tawny, proximad on each side

A paratype is apparently somewhat teneral, its general coloration being blackish chestnut brown

The measurements of a male paratype, bearing the same data, follow those of the male type Length of body 32 7 and 29, length of pronotum 9 and 8 8, width of pronotum 12 4 and 12 7, length of tegmen 22 9 and 23, width of tegmen 10 8 and 11, length of caudal tibia 11 5 and 12, length of caudal metatarsus 3 7 and 3 8 mm

Eurycotis blattoides new species Plate XV, figures 15 and 16

This is a very distinctive species, belonging to the black forms of the genus, with tegmina lateral In form it agrees best with *E manni* Rehn, described from the Maranguape Mountains, Ceara, Brazil, but it is very much smaller, with large ocellar spots, proportionately larger tegmina which have rounded apices and darker antennae but paler underparts and cerci

The male supra-anal plate is strongly bilobate distad, more so than in the known males of any other species. The tegmina resemble those of *E tibialis* Hebard, from San Domingo, that species belonging to a different group, as shown by its very broad form, decided production of the latero-caudal angles of the abdominal tergites and high specialization of the male caudal tibiae

Type. ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1017]

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[78] Saussure figures this plate for *alaris* as shorter, with lateral margins scarcely convergent to the broader and much less strongly bilobate apex.

Size small and form rather slender for this genus of large and broad species, surface polished. Head projecting moderately beyond pronotum, interocular space very wide, space between antennal sockets only about three-quarters as wide, ocellar spots oval.[80] Maxillary palpi with fifth joint slightly longer than fourth, considerably shorter than third. Pronotum convex, latero-cephalic angles well rounded but appreciable, lateral margins very feebly convex and divergent caudad, caudal margin subtruncate, very broadly and feebly convex. Tegmina lateral, rounded triangular, reaching to caudal margin of metanotum, surface very finely impresso-punctulate with apices broadly rounded. Wings represented by small rounded pads, entirely concealed by the tegmina. Abdomen with latero-cadual angles of first to sixth tergites minutely acute produced, this strongest on the fifth and sixth.[81] Supra-anal plate with lateral margins concave proximad, then straight and convergent between the cerci to the deeply bilobate apex. Cerci small, flattened styliform. Subgenital plate and styles as here described for *Pelmatosilpha guianae* on page 192. Caudal tibiae slender for the genus, slightly thickened distad with dorsal surface there faintly impressed. Caudal metatarsus very slightly longer than the combined length of the three succeeding joints. Pulvilli and arolia large. Tarsal claws heavy, simple, symmetrical.

Allotype. ♀, same data as type. [Hebard Collection.]

Agrees closely with male, differing only as follows. Form decidedly broader, particularly in abdominal portion. Supra-anal plate similar, but with apices of bilobation, as well as its median emargination, showing angulation. Subgenital plate of the valvular type, characteristic of the genus.

General coloration shining black with a chestnut tinge. Tegmina deep carob brown. Antennae hazel, becoming blackish brown proximad. Ocellar spots buffy. Ventral surface and femora deep kaiser brown, the tibiae and tarsi darker, deep carob brown or blackish brown.

The measurements of the type and allotype are as follows. Length of body ♂ 21.9, ♀ 21.8, length of pronotum ♂ 5.7, ♀ 6, width of pronotum ♂ 7.7, ♀ 8.1, greatest width of abdomen ♂ 8.8, ♀ 10.7, exposed length of tegmen ♂ 4.9, ♀ 5.7, width of tegmen ♂ 3.7, ♀ 4; length of caudal tibia ♂ 6.9, ♀ 6.9 mm.

In addition, two male and one female paratypes and a large immature female, from Kartabo, Bartica District, British Guiana, taken by Wm. Beebe, are in the Academy Collection.

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[80] In *manni* the ocellar spots are represented by minute buffy points.

[81] These productions are extremely feeble for the genus, in both *blattoides* and *manni*.

Periplaneta americana (Linnaeus)

1758 [*Blatta*] *americana* Linnaeus, Syst. Nat, Ed X, p 424 [America]

St Jean du Maroni, French Guiana, 1 ♂

This and the two following species are domiciliary pests, widespread in the American tropics

Periplaneta brunnea Burmeister

1838 *P*[*eriplaneta*] *brunnea* Burmeister, Handb Ent, II, Abth. II, pt. I, p 503 [♂, ♀ Chile, Demerara (= British Guiana).]

We recorded this species from St. Jean du Maroni, French Guiana, in 1921

Periplaneta australasiae (Fabricius)

1775 [*Blatta*] *australasiae* Fabricius, Syst Ent, p 271. ["In nave e mare Pacifico et regionibus incognitis revertente."]

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀

NYCTIBORINAE

Nyctibora tomentosa (Serville).

1839. *Blatta tomentosa* Serville, Hist. Nat. Ins, Orth., p. 86. [♂, Surinam (= Dutch Guiana)]

This is the species we recorded from Gourdonville and Charvein, French Guiana, as *N holosericea* Burmeister[52] As originally described, *tomentosa* agrees fully except in having the antennae annulate We feel almost certain that discoloration must have caused this in Serville's specimen, as it is very improbable that antennal annulation will be found in adults of any species of the genus Saussure's description of a female, determined as *tomentosa*, from tropical America, in 1870, agrees throughout except in giving "antennis ferrugineis"

Amazonian material is needed to assure the distinctness from *holosericea*, which name is further involved, having been placed as a synonym of *N brunnea* (Thunberg) by Shelford, in 1907.

St. Jean du Maroni, French Guiana, 3 ♀.

St Laurent du Maroni, French Guiana, December, 1 ♂.

Roches de Kourou, French Guiana, 1 ♂.

This is one of the largest species of the genus. It is related to the North American *N noctivaga* Rehn, differing only in certain features of coloration and in the more highly specialized male supra-anal plate To it *N tenebrosa* Walker[53] is very closely related, though of distinctly smaller average size.

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[52] Proc. Acad. Nat. Sci. Phila., 1921, p. 206, (1921)

[53] Material of *tenebrosa* from Demerara, British Guiana, is before us. It was recorded as *tomentosa* by Rehn in 1906.

Nyctibora tenebrosa Walker Plate XVI, figure 1

1868. *Nyctibora tenebrosa* Walker, Cat. Blatt. British Mus , p 147 [♀; ♀, Demerara (= British Guiana).]

Demerara, British Guiana, 1901, (R J Crew), 2 ♂

Bartica, British Guiana, December 5 and 11, 1912 and February 4, 1913, (H S Parish), 3 ♀, [Acad Nat Sci Phila]

St Jean du Maroni, French Guiana, 1 ♂

The average smaller size of this insect, when compared with *N tomentosa* (Serville) is particularly accentuated in the less ample organs of flight Both are sufficiently variable to make the validity of *tenebrosa* uncertain until much more material can be examined

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
tomentosa					
St. Laurent	36	9 7	14	42 5	15 2
Gourdonville	30	8 3	12 8	37 5	13 9
tenebrosa					
Demerara	31 8	8 8	12 1	33 7	12 7
Demerara	31 3	8 1	11 9	32 3	12 3
St. Jean	29 3	7 7	11	29 1	11
♀					
tomentosa					
St. Jean	36	9 7	14 1	38 2	14 5
Charvein	36	10	14 1	38 6	15
tenebrosa					
Bartica	36	8 8	12	32 7	13 1
Bartica	35 5	8 7	12	32	12 8

Nyctibora dichropoda new species, Plate XVI, figure 2

In superficial appearance this insect agrees closely with *N tenebrosa* Walker It may be readily separated, however, by the strikingly pale extensor surfaces of the tibiae and the simple, roundly produced male supra-anal plate In all other related species known to us this plate shows distinct specialization of its meso-distal portion

Type: ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1018.]

Size and form medium for the genus, much as in smaller individuals of *tenebrosa*, but with slightly more caudate organs of flight. Surface glabrous, thickly supplied with microscopic, procumbent hairs Interocular space extremely narrow, hardly over one-third width of proximal antennal joint Ocellar spots large, ocellar areas weakly defined Maxillary palpi with fifth joint elongate, almost as long as third, fourth joint three-fifths as long Pronotum evenly convex, point of greatest width very slightly caudad of median line, lateral margins evenly convex, the caudal margin showing a trace of angulation at the shoulders and mesad. Tegmina and wings strongly caudate, extending beyond the abdomen a distance nearly equal to the pronotal width, venation normal Abdomen with latero-caudal angles of fifth and sixth tergites strongly and roundly produced. Supra-anal plate produced between cerci, that portion rounded trapezoidal and symmetrical, about three-fifths as long as its basal width Cerci very elongate, tapering to the very slender apices Subgenital plate and styles of the general type characteristic of the genus; sinistral style situated proximad, straight, flattened, four times as long as proximal width, tapering strongly in second fourth, thence gradually to the sharply rounded apex, dextral style situated distad, two-thirds as long, weakly curved sinistrad, flattened, two and one-half times as long as proximal width, tapering gradually to the slightly less strongly rounded apex Armament of limbs of the usual type in this genus, the spines of the ventro-caudal femoral margins much the heavier Caudal metatarsus with pulvillus reaching one-third the distance to base Large arolium present between the strongly asymmetrical tarsal claws

Allotype ♀, same data as type [Hebard Collection]

Differs from the male as follows Form slightly more robust Organs of flight much shorter and broader Pronotum more ample; showing a trace of angulation instead of even curvature at point of greatest width, which is meso-caudad Tegmina more broadly rounded distad, exceeding abdomen by a distance half as great Supra-anal plate more strongly produced, lateral margins weakly convex-convergent to the apex which is briefly emarginate, the small lateral projections thus formed rounded Subgenital plate large, short, unspecialized

Head deep chestnut, paling to burnt sienna on face, mouthparts and palpi buffy, ocellar spots light ochraceous buff Antennae tawny Pronotum uniform shining chestnut brown Tegmina immaculate chestnut brown paling distad Trochanters blackish chestnut brown paling to apricot orange laterad Femora chestnut, paling to burnt sienna laterad, ventral surfaces tawny Tibiae and tarsi chestnut, the extensor surfaces of the former strikingly buff, in sharp contrast, with spines blackish brown. Ventral surface of abdomen blackish chestnut brown, broadly margined with hazel, this marginal band paler proximad, including subgenital plate and preceding sternite distad

Length of body ♂ 29, ♀ 33; length of pronotum ♂ 7.4, ♀ 9; width of pronotum ♂ 10 8, ♀ 11.3, length of tegmen ♂ 33 2, ♀ 31 7, width of tegmen ♂ 11, ♀ 11.3 mm

In addition to the described pair, an immature male is before us, bearing the same data

Pseudischnoptera lineata (Olivier)

1789 *Blatta lineata* Olivier, Encycl Méthod , Ins , IV, p 17 [No locality given]

St Jean du Maroni, French Guiana, 1 ♂, 2 ♀, 1 juv ♀

In the immature example the dorsal surface is shining blackish brown, rather broadly margined with light buff, this margin narrow in transverse cephalic portion and tinged with brown in transverse caudal portion

We have already recorded this striking insect, one of the most distinctive and handsome of the South American Blattidae, from the above locality and Kourou, French Guiana

Paratropes elegans (Burmeister)

1838 *Ph[oraspis] elegans* Burmeister, Handb Ent , II, Abth II, pt. I, p 493 [Surinam ? (= Dutch Guiana)]

We recorded a female of this species from La Forestière, French Guiana, in 1921

Paratropes phalerata (Erichson)

This species has been recorded from Cayenne, but is not represented in the material now before us

Megaloblatta insignis (Serville)

1839 *Kakerlac insignis* Serville, Hist Nat Ins , Orth , p 67 [♀, Cayenne (= French Guiana)]

St Jean du Maroni, French Guiana, July, 1 ♂

St Laurent du Maroni, French Guiana, December, 1 large juv ♀.

In this species the interocular space is narrow, 1 2 mm in the present male. In this feature it is probably intermediate between *M regina* (Saussure) from Brazil and eastern Ecuador, and *M. blaberoides* (Walker) from Nicaragua, Costa Rica and Panama [84]

This male measures as follows, length of body 57, length of pronotum 15 1, width of pronotum 22 2, length of tegmen 75 5, width of tegmen 29 8 mm

Though the limb coloration may prove unsafe for specific separation, it is so constant in the specimens of this genus before us, represented by a series of fourteen individuals, that we give the following data as a probable aid in separating these forms, which show so few specific diagnostic characters

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[84] The width of the interocular space is, for recorded material before us *blaberoides* ♂ 1 7, ♀ 2.4, *regina* ♀ 1 4, *longipennis* ♀ 2 7 mm.

A (Femora ferruginous), tibiae ferruginous
  B Tarsi chestnut brown *insignis* (Serville).
  BB Tarsi ferruginous *blaberoides* (Walker).
AA Tibiae chestnut brown
  B Femora deep ferruginous, tarsi chestnut brown *regina* (Saussure)
  BB Femora and tarsi chestnut brown *longipennis* (Walker).

EPILAMPRINAE

Notolampra punctata (Saussure)

1872. *Th[orax] punctata* Saussure, Mélang. Orth , Fasc IV, p 125 [♀, Brasil.]

St Jean du Maroni, French Guiana, 1 ♀, 1 small juv. ♂, 1 large juv. ♀.

The present female agrees in every detail with Saussure's description and measurements

In the immature condition, the fine lateral line of whitish on pronotum and tegmina proximad is absent and the abdominal tergites have a series of distinct nodes on their caudal margins

Epilampra abdomen-nigrum (DeGeer)

1773 *Blatta abdomen-nigrum* DeGeer, Mém l'Hist Ins , III, p 504, pl. 44, fig. 5. [[♂], Surinam (= Dutch Guiana).]

St Jean du Maroni, French Guiana, 2 ♀, 1 juv. ♂, 1 juv ♀.

St Laurent du Maroni, French Guiana, 1 juv. ♂.

Nouveau Chantier, French Guiana, May and September, 1 ♂, 1 ♀

Epilampra grisea (DeGeer)

1773. *Blatta grisea* DeGeer, Mém. l'Hist. Ins., III, p. 540, pl. 44, fig. 9. [Surinam (= Dutch Guiana).]

St Jean du Maroni, French Guiana, 4 ♂, 7 ♀.

We have previously recorded this species from Charvein, French Guiana. Walker's *E arctata*, described from British Guiana, is probably a synonym

Epilampra guianae new species. Plate XVI, figure 3.

This handsome species is apparently related to *E. crossea* Saussure, but is readily distinguished by its larger size, more uniform coloration, pronotum with minute punctulations all dark brown, tegmina with humeral trunk not as much darkened and adjacent portion of marginal field without a pale streak The fine and evenly distributed tegminal maculations are more apparent and ochraceous-tawny

Brunner's *E cinerascens*, described from Brazil, is apparently very closely related, differing from *guianae*, as far as can be told from the description, in the smaller size, testaceous head and apparently immaculate margins of the tegmina and wings

Type ♂, St Jean du Maroni, French Guiana October [Hebard Collection, Type no 1020]

Size rather small for the genus, form normal Interocular space slightly less than half that between antennal sockets Ocellar spots large, well defined, with flattened surfaces forming a sharp but obtuse angle with plane of the face Pronotum with lateral portions strongly deflexed, point of greatest width meso-caudad, caudal margin with median convex production decided Tegmina and wings elongate, well surpassing the very slender apices of the elongate cerci Ulnar vein of wings with numerous (fifteen in paratype) incomplete and few (three in paratype) complete branches Abdominal tergites all rounded and not produced laterocaudad Supra-anal plate subchitinous, decidedly produced, four-fifths as long as broad, lateral margins weakly convex convergent to the moderately bilobate distal portion Subgenital plate asymmetrically rounded, as characteristic of the genus, with two very slender styles, which are almost straight, cylindrical and about nine times as long as wide Cephalic femora with ventro-cephalic margin armed with a few heavy, well spaced spines proximad, succeeded by a row of microscopic, well spaced, piliform spines, with two heavy, elongate distal spines, other ventral femoral margins well supplied with heavy spines Caudal metatarsus very elongate and slender, distinctly longer than combined length of succeeding joints, armed ventrad with two rows of minute spines, which are continued on the two succeeding joints, four proximal tarsal joints each supplied with a moderately large, blunt, distal pulvillus Large arolia present between the simple, symmetrical and rather delicate tarsal claws

Color features are of the highest importance in recognising this and allied species General coloration buckthorn brown, very finely and evenly marked Head ochraceous buff, the occiput and interocular area vertically thickly streaked with mummy brown, a transverse streak of the same between the ventral margins of the light ochraceous buff ocellar spots, the face below with a pair of the same and in the Kaiteur paratype with numerous other minute dots. Pronotum buckthorn brown with very numerous, almost microscopic, evenly distributed dots of cinnamon brown, its caudal margin lacking conspicuous heavier dots. Tegmina buckthorn brown, thickly ornamented with very small, evenly distributed flecks of ochraceous tawny, these deepening to cinnamon brown along the immediate margins and on the humeral trunk; portion of dextral tegmen, concealed when at rest, immaculate, strongly tinged with tawny Wings hyaline, very faintly tinged with brown, becoming more tawny toward area of costal veins which is opaque ochraceous tawny, distal margin of anterior field regularly flecked with cinnamon brown (these flecks stronger in the Kaiteur individual) Mesonotum and metanotum buckthorn brown Abdomen dorsad buffy strongly tinged with orange, deepening to tawny distad Ventral surface of abdomen ochraceous buff tinged with brown, each abdominal sternite with a lateral dot of brown on each side Limbs ochraceous buff tinged with brown and with a few suffusions of slightly darker brown, particularly at bases of spines, but nowhere conspicuous

The measurements of the male type are followed by those of paratypic males from Rockstone and Kaiteur, British Guiana Length of body 18 8, 19 8 and 20 7, length of pronotum 4 8, 5 and 5, width of pronotum 5 3, 6 1 and 6 1, length of tegmen 17 8, 18 8 and 19 2, width of tegmen 5 3, 5 6 and 5 8 mm

Specimens Examined 3, 3 males

Kaiteur, British Guiana, July 23, 1911, (H. G. Crampton), 1 ♂, *paratype*, [Amer Mus Nat Hist].

Rockstone, British Guiana, July 20, 1911, (F. E. Lutz), 1 ♂, *paratype*, [Hebard Cln]

St Jean du Maroni, French Guiana, October, 1 ♂, *type*

Epilampra crossea Saussure

1864 *Epil[ampra] crossea* Saussure, Rev et Mag. de Zool , XVI, p 323 [[♀], Brazil]

Affinity to the Cuban *E burmeisteri* Guerin is plainly indicated

St Jean du Maroni, French Guiana, May, 1 ♂.

This individual agrees with Saussure's more detailed description[88] in all features except that the whitish streak below the humeral trunk of the tegmina is continued on the sides of the pronotum, the dark punctulations in it there being ochraceous tawny instead of black This may indicate specific difference, material representing both sexes of *crossea* and possibly series of specimens being needed before a definite decision can be reached

The measurements of the present male are; length of body 16 2, length of pronotum 3.8, width of pronotum 4 7, length of tegmen 15.4, width of tegmen 4 7 mm

An almost exactly similar male is in the Academy Collection, from Pará, Brazil, taken by C F Baker

Epilampra azteca Saussure.

1868 *Epilampra azteca* Saussure, Rev. et Mag. de Zool., (2), XX, p 356, [Mexico.]

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[88] Mém l'Hist. Nat. Mexique, Blattidae, p. 133, (1864).

We have recorded this species from La Forestière, upper Maroni River, French Guiana

Epilampra opaca Walker

1868. *Epilampra opaca* Walker, Cat Blatt British Mus , p 206 [♀, Demerara (= British Guiana)]

St Jean du Maroni, French Guiana, 1 ♂, 4 ♀

St Laurent du Maroni, French Guiana, 1 ♀

Nouveau Chantier, French Guiana, September and October, 2 ♀

Gourdonville, French Guiana, 1 ♀

This species may prove to be a synonym of the Brazilian *E maculicollis* (Serville), and the Ecuadorean *E stigmosa* Giglio-Tos may fall in the same synonymy Numerous distinct, though easily confused, species are known to belong to this group and, until a better concept of the distribution and individual variation within these is formed, we believe it best to use the name *opaca*

In the material before us the following features of coloration are particularly noticeable Interocular space dark A large pale spot present in the costal area of the wings Pronotum thickly punctulate, with a lyrate pattern weakly suggested Tegmina thickly though finely maculate, with darker maculations along the humeral trunk proximad Wings without flecks of brown along the costal margin distad The reverse of this latter feature is described for both *maculicollis* and *stigmosa*, while no pale marking in the costal area of the wings is mentioned for the former

We have recently recorded this species as *maculicollis* from La Forestière, French Guiana, and Rehn has done the same at an earlier date for a pair from Demerara, British Guiana, now in the author's collection.

Epilampra conspersa (Burmeister)

1838. *E[pilampra] conspersa* Burmeister, Handb Ent II, Abth. II, pt. I, p. 505 [Pará, Brasil]

St Laurent du Maroni, French Guiana, 2 ♀

We have previously recorded this splendid species from St Jean du Maroni, Nouveau Chantier and Tollinche, French Guiana Comparison has been made with an almost topotypic female, recorded by Rehn as *conspersa* in 1918 The insect is further discussed under the following species

Saussure and Zehntner further described *conspersa* in 1893, recording material from Cayenne (= French Guiana) and Vera Paz, Guatemala. We believe their Guianan specimen to be correctly determined, and not *E. sodalis* Walker,[34] as assigned by Kirby in 1904

Epilampra cinnamomea new species. Plate XVI, figure 4.

This insect is extremely close to *E. conspersa* (Burmeister), differing only in the general cinnamon instead of buffy brown coloration, mikado brown instead of mummy brown microscopic dots of head and pronotum, ferruginous instead of blackish brown margins of the ventral surface of the pronotal lateral lobes and marginal field of the tegmina and proximal abdominal sternites with triangular yellowish markings instead of an immaculate ventral surface of the abdomen

In size and form close agreement is found with topotypic females of *conspersa* before us, but the other Guianan females of that species are all distinctly more slender

Type ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1021]

Size medium large and form moderately broad for the genus, surface highly polished Interocular space broad, three-fifths width between antennal sockets Ocellar spots moderately large, their areas weakly defined Pronotum strongly decurved laterad, portion of greatest width slightly caudad of median line, caudal margin with median convex production decided Tegmina and wings fully developed, surpassing apex of supra-anal plate by about half the pronotal length Tegmina almost opaque to near apices, due to a whitish coating of their ventral surfaces. Wings with entire costal portion to discoidal vein opaque Abdominal tergites with latero-caudal angles feebly produced, rounded rectangulate to sixth, the caudal margin of which is broadly but strongly concave Supra-anal plate subchitinous, microscopically tuberculate, three-fifths as long as broad, produced bilobate, the rounded apices with a narrow, deep emargination between. Subgenital plate asymmetrically rounded as is characteristic of *Epilampra*. Sinistral style greatly atrophied, very small, slightly over twice as long as broad; dextral style very slender, almost straight, cylindrical, about eight times as long as wide Limb armament, pulvilli, arolia and tarsal claws as described for *E. guianae* on page 199 Caudal metatarsus longer than combined length of succeeding joints.

Allotype. ♀, same data as type. [Hebard Collection.]

Agrees closely with male Size distinctly larger. Head broader, interocular space slightly more than three-fifths width between antennal sockets Tegmina and wings quite as fully developed.

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[34] The head in *conspersa* appears immaculate, so finely is it speckled, but Walker gives for *sodalis* "front black."

Six abdominal tergites with latero-caudal angles sharply acute-angulate produced, those of the sixth very strongly so, as in this sex of *conspersa* Supra-anal plate more chitinous than in male, more produced, lamellate and very strongly bilobate, as in *conspersa* Subgenital plate as in that species, with meso-distal portion symmetrically trapezoidal produced with angles rounded, the free margin forming a sharp obtuse-angulation on each side before this

Apparently inseparable from *conspersa* by structural features, the color characters shown by this insect are of particular importance Head and pronotum uniform cinnamon buff, thickly and evenly supplied with microscopic dots of mikado brown, this giving to the naked eye a cinnamon tone Ocellar spots light ochraceous buff Antennae sayal brown, darkening slightly proximad at first joints Tegmina sayal brown, delicately marbled with clay color, costal margin very narrowly clear cinnamon buff (this obsolete in some paratypes) outer edge of cingulate margin there finely black, proximal half of portion of dextral tegmen, concealed when at rest, strongly tinged with orange cinnamon and tessellate distad Ventral surface of lateral lobes of pronotum and costal field of tegmina narrowly margined with ochraceous tawny, other portions of ventral surface of tegmina with a whitish deposit which makes them almost opaque to near their apices Wings hyaline, veins ochraceous tawny, surface distad tinged with ochraceous tawny and strongly so in area of branches of the ulnar vein, area of costal veins opaque ochraceous tawny, deepening to chestnut brown distad Dorsal surface of abdomen zinc orange gradually paling to buffy orange proximad and weakly tinged with tawny distad Ventral surface of body and limbs ochraceous tawny, the caudal limbs deeper, their tibiae and tarsi tawny Ventral surface of abdomen deep tawny, the third, fourth and fifth sternites with small, suffused, triangular, median areas of antimony yellow Cerci tawny, the last joint tipped with blackish brown

In the series some slight variation in the marbling of the tegmina is apparent, some having this more distinct than in others, while a very few show a tendency toward the drawing together of some of the pale marblings to form weakly defined spots, and in one a number of dark spots of bay precede these. So consistent is the entire series, however, in coloration that we feel obliged to recognize this insect as distinct from *conspersa*, though the general similarity of structure is unusual

The measurements of the type and allotype are followed by those of the extremes in the series of forty-six topotypic paratypes Length of body (to apex of supra-anal plate) ♂ 26 1, 21 2 to 25 8, ♀ 31 5, 29 8 to 30 7. length of pronotum ♂ 6.2, 5 4 to 6.5, ♀ 7 8, 7 2 to 7 9: width of pronotum ♂ 8, 6 8 to 8 2, ♀ 9 3, 9 to 9 7· length of tegmen ♂ 24 2, 22 to 25, ♀ 29, 26 1 to 30 width of tegmen ♂ 7.3, 6 1 to 7 7, ♀ 9, 8 2 to 9 2 mm

Specimens examined 53, 26 males, 25 females and 2 immature individuals

St Jean du Maroni, French Guiana, 26 ♂, 22 ♀, *type*, *allotype* and *paratypes*, 1 juv ♂, 1 juv ♀

Nouveau Chantier, French Guiana, February and December, 2 ♀, *paratypes*

St Laurent du Maroni, French Guiana, December, 1 ♀, *paratype*

Epilampra taira[87] **new species. Plate XVI, figure 5.**

This is a large and handsome species with pronotal disk dark, its lateral margins as well as those of the tegmina proximad pale, but with numerous punctae, the other portions of the tegmina finely and evenly maculate, these maculae only slightly darker proximad at the humeral trunk than elsewhere

It is apparently nearest *E maculifrons* Stål, described from Rio de Janeiro, Brazil That species is much larger (length including tegmina 50, instead of about 41 mm), with differently marked head and tegmina and paler ventral surface

Type ♀, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1022]

Size large and form broad for the genus, broader and with less caudate organs of flight than *E ventralis* Burmeister Surface highly polished Interocular space very broad, three-quarters width between antennal sockets Ocellar spots moderately large, their areas weakly defined. Pronotum as described for *E guianae* on page 199 Tegmina and wings fully developed, broad, surpassing apex of supra-anal plate by about half pronotal length. Six abdominal tergites with latero-caudal angles sharply acute-angulate produced, though not as strongly as in *E. conspersa* Burmeister and its allies Supra-anal plate chitinous, lamellate, its lateral margins convex convergent to the bilobate apex Subgenital plate with lateral margins very broadly and very feebly concave beneath cerci, median portion moderately produced, weakly convex Limb armament, pulvilli, arolia and tarsal claws as described for *E guianae* on page 199. Caudal metatarsus slightly longer than combined length of succeeding joints

Head blackish chestnut brown with mouthparts paler, the occiput entirely ochraceous buff, sending five very brief rays ventrad between eyes Ocellar spots light ochraceous buff Antennae blackish chestnut brown, dull in all but proximal portion, which is shining Pronotum blackish chestnut brown, the lateral portions ochraceous buff with scattered minute flecks of chestnut brown and cingulate margin cinnamon brown The lateral margins of the dark disk are not even as in *verticalis*, twice invading the pale margins briefly meso-cephalad and convex caudad Tegmina transparent, marginal field tinged with ochraceous buff and with margin and minute flecks of ochraceous tawny, other portions tinged with ochraceous buff and faintly tawny heavily and evenly covered with small maculae of russet, these smaller and darker proximad, there blackish chestnut brown Wings tinged with ochraceous tawny Dorsal surface of abdomen ochraceous tawny, the tergites suffused with blackish chestnut brown proximad, these transverse bars interrupted laterad but expanding at the lateral margins, supra-anal plate chestnut brown, cerci slightly paler Ventral surface and limbs deep chestnut brown, paling to hays russet mesad on abdomen, the three proximal abdominal sternites each with a buffy fleck mesad on each side

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[87] The Taira are Indians, belonging to the Carib stock, living in the interior of French Guiana.

The measurements of a paratypic female, bearing the same data, follow those of the female type Length of body 37 8 and 36 5, length of pronotum 9 and 8 8, width of pronotum 11 8 and 11 7, length of tegmen 34 and 33, width of tegmen 11 and 10 8 mm

Epilampra egregia new species. Plate XVI, figure 6.

This is the third species of the genus known, in which the female is highly modified, with lateral tegminal pads The others are *E. jorgenseni* (Rehn) and *E berlandi* Hebard, both from the Argentine

Compared with the female of *jorgenseni*, the present female is seen to have the flattened face rougher, the form not as broad with dorsal surface slightly more convex, and to differ in having numerous decided rugae at the caudal margin of pronotum, mesonotum, metanotum, median segment and six tergites, and a weak medio-longitudinal carina on the supra-anal plate

Compared with an immature female of *Rhicnoda rugosa* Brunner,[33] these females are found to agree closely in the majority of features, that insect differing principally in having the pronotum extending distinctly beyond the head, the subgenital plate distad transversely concave laterad and convex mesad, the eyes much more reduced and the arolia vestigial

Type ♀, St Jean du Maroni, French Guiana 1903 (F Geay) [Hebard Collection, Type no 1023]

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[33] Recorded Mem Amer Ent Soc , No. 4, p. 98, (1919).

Size medium, form very decidedly depressed, surface rough but weakly polished Head with margin of occiput just visible beyond pronotum, facial portion flat and roughened, interocular space narrowest dorsad, there three-quarters width between antennal sockets Ocellar spots very weakly indicated, less distinct than in this sex of *jorgenseni* Antennae less than half as long as body Pronotum roughly symmetrically trapezoidal in form, the cephalic margin weakly convex, the lateral margins very weakly convex divergent to the slightly produced acute latero-caudal angles, the caudal margin transverse, showing very broad concavity on each side. Pronotum moderately cucullate above head, lateral portions deflexed to the narrowly reflexed lateral margins, caudal margin with eight strong, short, rounded, longitudinal rugae Similar rugae occur on the caudal margins of the mesonotum, metanotum, median segment and first six abdominal tergites, the greatest number on one tergite being ten Tegmina represented by lateral squamiform appendages, with apices projecting as a minute point a brief distance beyond caudal margin of mesonotum, generally similar to those of females of *jorgenseni*, but with humeral trunk slightly more distinct Wings absent Metanotum and six tergites with latero-caudal angles acute-angulate produced, those of the first tergite being the strongest Supra-anal plate transverse, slightly over half as long as wide, slightly reflexed toward lateral margins and with a weak medio-longitudinal carina, lateral margins convex convergent to a small median obtuse-angulate emargination Cerci about half as long as supra-anal plate, broad fusiform, depressed, not jointed Subgenital plate large, the free margin arcuate, with a shallow emargination before each cercus Limb armament showing marked reduction, but as described for *E. guianae* on page 199 except that there is but one spine distad on the ventro-cephalic margin of the cephalic femora Caudal metatarsus, arolia and tarsal claws as described for *guianae* Pulvilli small but distinct

General coloration chestnut brown with a weak metallic sheen, paling to cinnamon brown laterad on pronotum and tegmina and narrowly between rugae on caudal margins of abdominal tergites and at apices of cerci. Face blackish mummy brown, eyes russet, narrow vertex, ocellar spots and mouthparts buffy Antennae blackish, then suddenly dull zinc orange, after about nine joints deepening to dresden brown distad Limbs deep bay Ventral surface of abdomen deep chestnut brown

The measurements of this unique female type are, length of body 20 8, length of pronotum 5 7, width of pronotum 10.3, greatest exposed (internal) length of tegmen 4 8,[11] width of tegmen 2 9, greatest width of abdomen 12 7 mm.

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[11] For *jorgenseni* this dimension is 4 9 mm.

Hyporhicnoda maronensis Hebard.

1921 *Hyporhiconda maronensis* Hebard, Proc Acad Nat Sci Phila., 1921, p. 207, pl. XII, fig. 5 [♀, juv ♀, La Forestière and Ilet la Mère, French Guiana.]

St. Jean du Maroni, French Guiana, 3 ♀

The pale suffusion on each side of the median point of the cephalic margin of the pronotum is apparently a valuable specific diagnostic feature in at least the female sex of this insect

PANCHLORINAE

Leucophaea maderae (Fabricius)

1781 *B[latta] maderae* Fabricius, Spec. Ins , I, p 341 [Madeira.]

St Jean du Maroni, French Guiana, 2 ♂

This domiciliary pest is widely distributed through the American tropics

Pycnoscelus surinamensis (Linnaeus)

1767 [*Blatta*] *surinamensis* Linnaeus, Syst Nat , Ed XII, p 687 [Surinam (= *Dutch Guiana*)]

St Jean du Maroni, French Guiana, 2 ♀, 1 large juv ♀

This species is widely distributed through tropical and subtropical America. It prefers the vicinity of human habitations, though it is not strictly domiciliary

Panchlora cubensis Saussure.

1862. *P[anchlora] cubensis* Saussure, Rev. et Mag. de Zool., (2), XIV, p 230 [♀, Cuba.]

1864 *P[anchlora] luteola* Saussure, Rev et Mag. de Zool , (2), XVI, p 342 [Surinam (= Dutch Guiana)]

We feel fully justified in placing *luteola* under *cubensis*, as first indicated by Kirby This is the most widely distributed species in tropical America and in nearly all regions the most abundant, though such is apparently not the case in French Guiana, as is shown by the much larger series of *P nivea* (Linnaeus) now before us. The first record referable, in all probability, to the present insect is Burmeister's from Cuba, as *viridis*,[90] in 1838 Since that time *cubensis* has been repeatedly recorded as *virescens*, *viridis nivea*, *hyalina*, *poeyi* and *exoleta*

St Jean du Maroni, French Guiana, May and November, 2 ♂, 8 ♀

St Laurent du Maroni, French Guiana, January and October, 2 ♀.

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[90] Fabricius described *viridis* in 1775 from America, as of the same size as *nivea* That name has been placed as a synonym of *nivea* by Kirby. Unless the type can be found and critically examined, however, that name we believe is best considered unidentifiable.

Nouveau Chantier, French Guiana, January, February, May, August, September, October and December, 4 ♂, 6 ♀.

La Forestière, upper Maroni River, French Guiana, July, 1 ♂

We have also recorded this common species from Ouanary, French Guiana

Size difference is considerable in this series, the total length, including tegmina, of the extremes being: ♂ 17 8 to 19; ♀ 23 5 to 28 5 mm Series of the species often show such size diversity

Panchlora bidentula Hebard

1916 *Panchlora bidentula* Hebard, Ent News, XXVII, p 221, fig 1 [♂: Igarapé-Assú, Pará, Brazil, Caparo, Trinidad]

St. Jean du Maroni, French Guiana, 3 ♂, 4 ♀

Comparison with a large series of *P nivea* (Linnaeus) shows this to be a closely related species, differing in the average slightly larger size, broader form, slightly wider interocular space and more ample pronotum The male genitalia are distinctive, the subgenital plate in *nivea* being convexly produced sinistrad, but in *bidentula* symmetrical or nearly so, with two rounded projections meso-distad, flanking a weak median concavity of its caudal margin

The previously unknown female has the interocular space two-thirds to three-quarters the greatest diameter of the eye, which in *nivea* is one-fifth to one-sixth that diameter The ample pronotum and broad tegmina further assist in recognizing the less easily separated female of *bidentula*

The measurements of the females here recorded are, length of body 14 9 to 15 2, length of pronotum 4 5 to 4 8, width of pronotum 5 2 to 5 9, length of tegmen 14 8 to 15 9, width of tegmen 4 8 to 5.2 mm

An additional Brazilian male is in the author's collection, taken at Parintins, Pará, September 28, 1919, by H. S Parish

Panchlora nivea (Linnaeus)

1758 *B[latta] nivea* Linnaeus, Syst. Nat , Ed. X, p 424 [America.[91]]

Shelford reported examining the type of *P. virescens* Thunberg,[92] described from an unknown locality, and synonymized that name under *nivea*.

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[91] By inference Surinam. See Shelford, Trans. Ent Soc London, 1907, p 463. His measurements of the male he considered the type of *nivea* are greater than those of any male in the present series. "Length of body 12, length of pronotum 3 9, width of pronotum 4.1, length of tegmen 13 5 mm."

[92] We are informed by Dr. Y. Sjöstedt that the type of *virescens* is not in the Stockholm Museum.

The only additional recorded material apparently referable to *nivea* is the specimen so reported by Saussure in 1864, from Cayenne, and apparently the same individual, a female, recorded by Saussure and Zehntner as *viridis* in 1893.

Bartica, British Guiana, January 8, 1913, (H. S. Parish), 1 ♀, [Acad. Nat. Sci. Phila.]

Tumatumari, British Guiana, July 12 to August 18, 1911, (F. E. Lutz), 3 ♂, 3 ♀, [Amer. Mus. Nat. Hist.]

Paramaribo, Dutch Guiana, (K. Mayo), 1 ♂, 1 ♀, [Acad. Nat. Sci. Phila.]

St. Jean du Maroni, French Guiana, January, February, May, June, August, November, 7 ♂, 10 ♀.

Nouveau Chantier, French Guiana, January, February, April. May, June, July, October, 7 ♂, 23 ♀.

St. Laurent du Maroni, January, August, 2 ♀.

Gourdonville, French Guiana, 2 ♀.

La Forestière, upper Maroni River, French Guiana, July, 1 ♂, 1 ♀.

Comparison with *P. bidentula* Hebard has here been made under that species.

The extremes of the present large series measure as follows. Length of body ♂ 9 to 11.2, ♀ 12.9 to 14.9, length of pronotum ♂ 2.8 to 3.8, ♀ 3.8 to 4.3, width of pronotum ♂ 3.7 to 4.2, ♀ 4.8 to 5.1, length of tegmen ♂ 9.8 to 12, ♀ 13.3 to 15.2, width of tegmen ♂ 3.2 to 4.2, ♀ 4.3 to 5 mm.

Not only is *nivea* the smallest known species of the genus, but it was also the first to be described.

Panchlora aurora new species. Plate XVI, figures 7 and 8.

This species, of delicately beautiful coloration, belongs with those forms having black lateral lines on the pronotum.

It is distinguished by the uniform pale antennae and the tegmina with a broad yellow band running to near the apex on the costal margin, this band ornamented with very small dark dots along its inner margin distad. The tegmina thence are a most delicate green, shading rapidly into a milky iridescence, which coloring largely contributes to the unusual beauty of the insect.

Type ♂, La Forestière, upper Maroni River, French Guiana. August. [Hebard Collection, Type no. 1024.]

Size and form medium for the genus. Head with eyes very deep in front, attingent through nearly dorsal half. Pronotum and tegmina of normal form, narrow lateral portions of pronotum clear toward the margins, subopaque toward the disk, marginal field of tegmina with all but immediate margin opaque Tegmina and wings very delicate Supra-anal plate subrectangulate, four times as broad as long; lateral margins straight and feebly convergent to the broadly rounded latero-caudal angles, distal margin with lateral portions straight and faintly oblique, causing a broad and feeble emargination of the entire distal margin, with a small median emargination, sharply angulate at slightly more than ninety degrees Cerci small, exceeding supra-anal plate by nearly half their length, flattened lanceolate, tapering to the narrow and sharply rounded apices, last joint only elongate, twice as long as its basal width Subgenital plate narrowly projecting, production greatest mesad, free margin very broadly and feebly convex except in dextral portion where it is very broadly and feebly concave Styles similar, very elongate and slender, two-thirds as long as cerci and reaching to base of ultimate cercal joint Femora without spines on ventral margins, ventro-cephalic margin of cephalic femora supplied with a fringe of minute spiniform hairs Pulvilli present on four tarsal joints. Moderate arolia present between the simple, symmetrical tarsal claws

Allotype ♀, St Jean du Maroni, French Guiana [Hebard Collection]

Size larger and form broader than male Eyes separated by a very narrow interval, slightly less than half width of proximal antennal joint Supra-anal plate very delicate, more produced than in male, margins convex laterad and very feebly so distad, with a very deep and narrow median emargination, which gives a bilobate contour to the plate Cerci as in male, projecting as far as supra-anal plate. Subgenital plate large, free margin convex except for a broad and very weak median concave emargination

Head ochraceous buff, tinged with tawny between the blackish brown eyes Antennae uniform ochraceous buff with a tawny tinge Pronotum pale cendre green, a very slender line of mummy brown before the narrow lateral portions preceded by a narrow line of mustard yellow, the lateral portions subopaque and tinged with pale cendre green toward the disk Tegmina with costal margin broadly mustard yellow to near apex, this marginal band with a row (varying individually from nine to eighteen in the paratypes[illegible]) of minute dots of blackish brown on its internal margin distad, the band there sometimes tinged with salmon Adjacent to this band, the tegmina are light cendre green, the remaining portions delicately tinged with pale turquoise green, which fades rapidly, the distal portion and that toward the sutural margin being nearly colorless Wings clear hyaline, somewhat iridescent,

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[illegible] A British Guiana female before us is very highly colored and has twenty-six such dots on the tegmen.

area of costal veins opaque, cream color Body and limbs ochraceous buff

In one paratype the yellow marginal bands of the pronotum and tegmina and area of costal veins of the wings are buff pink

The measurements of the type and allotype are followed by those of a male paratype, a female paratype and the female from British Guiana[94] before us Length of body ♂ 14 and 16 2, ♀ 18, 19 and 20 8, length of pronotum ♂ 3 9 and 4 6, ♀ 4 8, 5 2 and 6 1, width of pronotum ♂ 4 8 and 5 7, ♀ 5 9, 6 2 and 7 2, length of tegmen ♂ 14 and 16 5, ♀ 18 1, 19 3 and 23 1, width of tegmen ♂ 4 7 and 5.3, ♀ 5 9, 6 3 and 7 2 mm

Specimens Examined 10, 2 males and 8 females

Kalacoon, Essequibo River, British Guiana, (Wm Beebe), 1 ♀, [Acad Nat. Sci Phila]

St Jean du Maroni, French Guiana, 5 ♀, *allotype* and *paratypes*

Nouveau Chantier, French Guiana, February, 2 ♀, *paratypes*

La Forestière, upper Maroni River, French Guiana, August, 1 ♂, *type*

"Cayenne," 1 ♂, *paratype*

Panchlora regalis new species. Plate XVI, figure 9.

The present insect is unusually distinctive It apparently is nearest the Costa Rican *P nigriventris* Shelford, but differs widely from that insect in the narrower interocular space, smaller pronotum though the body bulk is similar, decidedly more caudate tegmina and wings, dark antennae with a brief pale distal annulus, immaculate pronotal disk, remarkably marked tegmina, bicolored limbs and intricately pictured ventral abdominal surface

Type ♀, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1025]

Size large, form normal for the genus Head with interocular space flattened, slightly less than half greatest dorsal ocular depth Pronotum and tegmina of normal form, but slightly broader than in *P aurora* here described, narrow lateral portions of pronotum strongly suffused but translucent, as is the external half of the tegminal marginal field, the internal half of that field being opaque Supra-anal plate much as described for *aurora*, projecting beyond subgenital plate, though not as much as in that species Cerci tapering to the sharply rounded apices, projecting only as far caudad as the lateral portions of the supra-anal plate Subgenital plate large, free margin convex except for very broad and shallow concavity on each side and median portion truncate. Ventral femoral margins with a small rudimentary distal spine, otherwise as in *aurora*, pulvilli, arolia and tarsal claws similar

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[94] This specimen is much larger than any other of the present series.

Head ochraceous tawny, deep chestnut brown between the eyes, occiput clay color Antennae blackish brown, with a clay colored annulus (composed of four joints) meso-distad Pronotum clay color suffused with ochraceous tawny (darker) laterad and caudad, disk defined from lateral portions by a line of blackish chestnut brown, lateral portions translucent, tinged with ochraceous tawny Tegmina proximad subopaque light ochraceous buff, becoming almost clear hyaline distad, marginal field in inner half opaque and rich ochraceous buff, in outer half translucent tinged with ochraceous tawny The tegmina are beautifully marked, as follows, a large spot of blackish brown at base of humeral trunk, almost wholly overlaid with glaucous gray, a spot of russet in opaque portion of marginal field opposite median portion of anal field; an oblique line slightly beyond and paralleling anal sulcus and nearly crossing discoidal field, its costal half russet, its sutural half blackish chestnut brown; two large oval dots of ochraceous tawny distad, the first on the discoidal vein, the other mesad in the discoidal field Limbs and their spines cinnamon brown tinged with russet, the tibiae and apex of last tarsal joint contrastingly blackish chestnut brown Ventral surface of thorax with two lateral buffy areas, each with a median spot of blackish brown Abdomen ochraceous tawny, the ventral surface within the margin showing a peripheral band of blackish chestnut brown which is sharply and intricately sculptured

This female type measures; length of body 21.4, length of pronotum 6 1, width of pronotum 7 3, length of tegmen 22 2, width of tegmen 7 2 mm.

Achroblatta luteola (Blanchard)

1843. *Blatta luteola* Blanchard, in d'Orbigny, Voy. Amér. Mérid , VI, pt. 2, p 215, pl 26, fig. 8. [Santa Cruz, Bolivia.]
1868. *Pseudomops lituriceps* Walker, Cat Blatt British Mus., p. 83. [♀; Ega, [Brasil]]

The markings of this species are so fully described by Walker that the synonymy of *lituriceps* is evident.

St Laurent du Maroni, French Guiana, June, 1 ♀.

The three dark suffusions on the vertex are usually concealed by the pronotum and occasionally the median of these is very weak. The present specimen agrees very closely with the specimen described as *lituriceps* by Walker, the face and ventral surface being pale with tips of tibiae very dark, but there is no darkening of the abdomen as he described Often in the species the face, limbs and abdomen are much darkened, so it is evident that the present specimen is recessively colored.

Known from Mexico to Bolivia, the species has been found east of the Andes only at Ega and St. Laurent du Maroni.

Schizopilia fissicollis (Serville)

1839. *Blatta fissicollis* Serville, Hist. Nat. Ins., Orth., p. 85. [♀, Cayenne (= French Guiana).]

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀, 2 juv. ♂, 2 juv. ♀.
St. Laurent du Maroni, French Guiana, 1 ♂, 1 ♀.

The sexes of this extraordinary and handsome species are very similar in size and tegminal development. The specimens from St. Laurent are smaller than the others, as were those we previously recorded from there when compared with a series from La Forestière.

The measurements of the males here recorded are: length of body 37 and 40, length of pronotum 10.9 and 12.1, width of pronotum 18.6 and 20.4, depth of lateral transverse pronotal fissure 3.4 and 3.7, length of tegmen 31.8 and 35.6, width of tegmen 15.7 and 17.5 mm.

The earlier immature stages of this insect agree closely with the later immature stages of *Zetobra emarginata* Burmeister, differing principally in the longer head, more strongly concave interocellar area and non-annulate antennae. In these no trace of pronotal lateral fissation is to be found.

Zetobora emarginata (Burmeister)

1838. *Z[etobora] emarginata* Burmeister, Handb. Ent., II, Abth. II, pt. I, p. 511. [Pará, Brazil.]

St. Jean du Maroni, French Guiana, 1 ♂, 2 ♀, 5 juv. ♂, 1 juv. ♀.
Nouveau Chantier, French Guiana, 3 ♂.

We have also recorded this species from La Forestière, French Guiana, at that time figuring the pronotal outline and establishing the synonymy of *Z. cicatricosa* Burmeister.

We have compared the immature stages under *Schizopilia fissicollis* (Serville). Confusion with immature individuals of *Phortioeca nimbata* (Burmesiter) is also possible. They are, for that insect, less lamellate, with median portion of median segment dark instead of pale.

Zetoborella gemmicula (Hebard)

1921. *Zetoborella gemmicula* Hebard, Proc. Acad. Nat. Sci. Phila., 1921, p. 211, pl. XIII, figs. 1 and 2. [♂, ♀, St. Jean du Maroni and St. Laurent du Maroni, French Guiana.]

St. Jean du Maroni, French Guiana, 1 ♂.

Phortioeca nimbata (Burmeister).

1838 *Z[etobora] nimbata* Burmeister, Handb Ent II, Abth. II, pt. I, p 511 [Pará, Brasil]

St Jean du Maroni, French Guiana, 3 ♂, 2 ♀, 4 juv ♂, 9 juv ♀

Nouveau Chantier, French Guiana, 1 ♂, 3 ♀

We have previously recorded *nimbata* also from La Forestière, Paniacabo and Charvein, French Guiana, there discussing its generic position

The size variation in the specimens here recorded is shown by the following extremes Length of body ♂ 20 to 24 8, ♀ 23 8 to 24 8; length of pronotum ♂ 6 to 7, ♀ 6 7 to 7 2, width of pronotum ♂ 9 4 to 11 4, ♀ 10 7 to 11 9, length of tegmen ♂ 19 3 to 23 7, ♀ 21 to 23 3, width of tegmen ♂ 7 4 to 8 9, ♀ 8 2 to 9 2 mm.

The immature condition of this insect is briefly discussed under *Zetobora emarginata* Burmeister in the present paper

BLABERINAE

Blaberus giganteus (Linnaeus)

1758 *B[latta] gigantea* Linnaeus, Syst ·Nat , Ed X, i, p 424 [America]

Illiger's synonym *colossa* was described from Demerara

St Jean du Maroni, French Guiana, May, 1 ♂, 1 ♀.

St Laurent du Maroni, French Guiana, 1 large juv. ♀; September, 1 ♂

Nouveau Chantier, French Guiana, 2 ♀

Paniacabo, Kourou River, French Guiana, October, 1 large juv. ♂

La Forestière, upper Maroni River, French Guiana, January, 1 ♀.

The length, including tegmina, of the largest female in this series, is 84 mm

Eublaberus biolleyi (Rehn).

1906 *Blaberus biolleyi* Rehn, Proc. Acad Nat Sci Phila., 1905, p. 792, fig. 1 [♀, Reventason River, plains of Santa Clara, Costa Rica.]

St Jean du Maroni, French Guiana, 2 ♂, 2 ♀

St Laurent du Maroni, French Guiana, March, 1 ♂.

Nouveau Chantier, French Guiana, February, 2 ♀.

In these specimens the pronotal markings are variable, but are decided for the species in all.[95]

Eublaberus posticus (Erichson)

1848 *Blabera postica* Erichson, in Schomburgk, Reisen British Guiana, III, p 580. [British Guiana.]

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[95] See Proc. Acad Nat. Sci Phila., 1921, p. 213, pl XIV, figs. 5 to 7, (1921).

Nouveau Chantier, French Guiana, February and September, 3 ♀

St Jean du Maroni, French Guiana, 2 ♀.

"Cayenne," 1 ♀.

The suffusion of the dark pronotal pattern is very strong for this species in all of the specimens here recorded

Like that of the preceding species, the distribution of *posticus* extends to the plains of Santa Clara, Costa Rica, Rehn having correctly recorded material from there in 1905 and from Demerara, British Guiana, in 1906 Two males from Paramaribo, Dutch Guiana, taken by K Mayo, are also in the Academy Collection

CORYDIINAE

EULISSOSOMA new genus

This genus is erected to include the single solidly dark brown species *E stygia* here described Though superficially most resembling the Argentinian *Lanta scotaia* Hebard, this insect is very widely distinct It differs from that genus in the very wide interocular space, smoothly rounded interocular-ocellar area, smooth and hairless pronotum and tegmina, tegmina with area of costal veins wider and these veins fewer and discoidal sectors oblique, wings more elongate with clubbed costal veins more oblique and ulnar vein branching further distad but with more branches, cephalic femora with only a single distal and no proximal heavy spines on the ventro-cephalic margin, median and caudal femora with ventral margins armed with a number of delicate but large spines, absence of pulvilli and vestigial arolia

These genera agree in the sinistral tegmen lacking a diagonal channel, the wings with radiate field folding fan-wise, and unspecialised dorsal surface of abdomen In this combination of characters they differ from all previously known genera of the Corydiinae

Other features of generic value, shown by the male sex, are as follows: Size very small, form moderately broad for the group; weakly convex surface highly polished and entirely without pile Eyes very widely separated Ocellar spots distinct, but their areas weakly defined in contour Pronotum with lateral margins convex and point of greatest width meso-caudad, cephalic and much broader caudal margins very feebly convex, almost transverse; latero-caudal sulci of disk shallow but distinct Tegmina and wings extending well beyond cercal apices Tegmina with median and discoidal veins parallel, several of the rather few discoidal sectors branching and all oblique

Eulissosoma stygia new species Plate XVI, figure 10

Though very distinct, this species shows nearest general affinity to *Tairella carinatifrons* here described, comparison being made under the generic description of that insect.

Type ♂, Charvein, lower Maroni River, French Guiana July. [Hebard Collection, Type no 1030.]

In addition to the characters given in the generic diagnosis, the following are noteworthy. Occipital ocular depth about one-third interocular width Ocellar spots moderately large, but rounding evenly into the interocellar area Space between antennal sockets slightly over two-thirds interocular width Distal joint of maxillary palpi very slightly longer than third, fourth three-fifths as long as third Pronotum with latero-cephalic angles much more broadly rounded than the latero-caudal Costal veins of tegmina (thirteen) somewhat irregular, due to branching, discoidal sectors (seven) similarly somewhat irregular Wings with costal veins well clubbed, ulnar vein with three, very distal, complete branches, intercalated triangle very narrow Supra-anal plate with length slightly over one-third width, broadly but not deeply bilobate distad. Cerci rather large and broad, flattened dorsad, lanceolate Subgenital plate with lateral portions reflexed, distal margin transverse, on each side with a small, stout style, directed dorsad and reaching to dorsal margin of reflexed portion, its rounded apex there curved caudad

General coloration deep bister, narrow lateral margins of pronotum and marginal field of tegmina paler Ocellar spots light buff, mouthparts ochraceous buff. Wings uniformly strongly suffused with bister, this deepest along free margin of anterior field. Mesonotum, metanotum and dorsal surface of abdomen tawny olive proximad, the latter deepening to chestnut brown distad Limbs cinnamon buff, their dorsal surfaces strongly suffused with bister.

The measurements of the unique male type are, length of body 6 5, length of pronotum 1.95, width of pronotum 2.6, length of tegmen 6 7, width of tegmen 2 2 mm.

This species belongs to a section of the Blattidae which will long afford one of the most interesting, though difficult, fields of investigation. The species are very small and their habitat usually so difficult of access that only occasional individuals are secured. Their structure is extremely varied and we have already sufficient information to know that many are symbiotic. Their life histories will, therefore, probably prove unusually interesting and diversified. The great dissimilarity between the sexes in the majority of species will undoubtedly often make sex association very difficult.

TAIRELLA new genus

This genus is proposed to include the one species *T. carinatifrons* here described. It is nearest *Eulissosoma*, described on page 215, the male sex agreeing in the smooth and hairless pronotum and tegmina, general type of pronotum and its latero-caudal sulci, tegmina which lack a diagonal channel and have the discoidal sectors oblique, wings with clubbed costal veins and radiate field folding fan-wise and ventral margins of median and caudal femora with a number of spines.

It differs in the strongly defined ocellar spots with a sharp carina delimiting the ventral margin of the interocular area, wings with ulnar vein branching proximad and intercalated triangle rather large, dorsal surface of abdomen specialised, cephalic femora with ventro-cephalic margin armed with heavy spines proximad and with two heavy distal spines, four tarsal joints with a pulvillus and moderately large arolia.

Both show a Pseudomopine facies more strongly than any of the allied genera, this the more pronounced in *Tairella*.

Other features of generic value are: Size large for this group of very small species, form moderately broad for the group; weakly convex surface highly polished and entirely without pile. Eyes widely separated, ocellar spots large, their areas very sharply defined in contour. Pronotum of the type found in *Eulissosoma*. Tegmina and wings extending considerably beyond cercal apices. Tegminal venation as described for *Eulissosoma*.

The female of these genera may be a very differently formed, apterous insect.

Tairella carinatifrons new species. Plate XVI, figures 11 and 12

At first glance this male appears to differ largely from the male here described as *Eulissosoma stygia* in being larger, slightly paler and in having longer organs of flight. Closer examination shows that, though these species apparently belong to a previously unknown group, they differ very widely in many important features, as noted above.

Type: ♂; Nouveau Chantier, French Guiana. October. [Hebard Collection, Type no. 1031.]

In addition to the generic characters, the following are noteworthy Occipital ocular depth slightly over half width of interocular space Space between antennal sockets about four-fifths interocular width Interocular area flattened, terminated ventrad in a fine ridge above the ocellar spots, this ridge obliquely declivent on each side and transverse between Ocellar spots large, their ridged dorsal margins forming almost a rectangle with the plane of the interocular area but curving evenly into the interocellar area Distal joint of maxillary palpi slightly shorter than third, fourth three-quarters as long as third Pronotum with latero-cephalic angles somewhat more broadly rounded than the latero-caudal. Costal veins of tegmina (nineteen) with few branches, discoidal sectors (nine) with distinct intercalated veinlets Wings with costal veins heavily clubbed distad, ulnar vein with four branches; intercalated triangle nearly as wide as deep Sixth dorsal abdominal tergite with a large median tuft of agglutinated hairs Supra-anal plate less than one-fifth as long as proximal width, lateral margins almost straight and very strongly convergent to a minute median emargination Cerci rather slender, moniliform, elongate lanceolate Subgenital plate reflexed sinistro-laterad, concave produced dextrad leaving a small median emargination, its median portion produced dorsad as a minute triangular projection with apex curved caudad, its lateral portions filled by the very small, short, cylindrical styles Styles slightly less than twice as long as broad, with apices bluntly rounded Minute median projection of subgenital plate with dorsal surface of apex armed with microscopic teeth

General coloration of head and pronotum blackish bister, the narrow lateral margins of the latter and the tegmina snuff brown Ocellar spots light buff Antennae ochraceous buff deepening to snuff brown distad Mouthparts dark Maxillary palpi with three proximal joints blackish bister, fourth and fifth joints proximad blackish bister, distad light buff Wings hyaline, very faintly tinged with bister only toward intercalated triangle and heavily so in area of costal veins, to and including apex of anterior field. Dorsal surface of mesonotum, metanotum and abdomen snuff brown, the latter becoming chestnut brown toward the margins Limbs and ventral surface of abdomen blackish brown, the former with tarsi ochraceous buff

The measurements of the unique male type are; length of body 8, length of pronotum 2, width of pronotum 3, length of tegmen 8 8, width of tegmen 2 7 mm

Latindia dohrniana Saussure and Zehntner.

1894. *Latindia dohrniana* Saussure and Zehntner, Biol. Cent.-Amer , Orth., I, p. 111, pl V, fig. 7 [♀, Guatemala.]

St. Laurent du Maroni, French Guiana, 1 ♀

We have previously recorded a female of this widely distributed species from St Jean du Maroni, French Guiana

Oulopteryx dascilloides Hebard

1921 *Oulopteryx dascilloides* Hebard, Proc Acad Nat Sci Phila., 1921, p. 215, pl XV, figs 5 and 6 [♂, Pariacabo, French Guiana.]

St. Jean du Maroni, French Guiana, 1 ♂

The appendicular fields of the tegmina, of this small, shining blackish brown cockroach, are tightly rolled when at rest This feature readily separates it from any other known species of the Guianan fauna

Holocompsa nitidula (Fabricius)

1781 *B[latta] nitidula* Fabricius, Spec Ins., I, p 345 [[♀], Surinam (= Dutch Guiana)]

St Jean du Maroni, French Guiana, 1 ♂, 2 ♀

St Laurent du Maroni, French Guiana, 1 ♀

We have also before us a large immature female from St Jean du Maroni which may represent this species Its dorsal surface is vandyke brown, well supplied with microscopic hairs

Sphecophila polybiarum Shelford

1907 *Sphecophila polybiarum* Shelford, Trans Ent Soc London, 1906, p. 518 [♂, Sainte Marie, Oyapock [River], French Guiana.]

The author has now received one paratype and four topotypes of this insect from the Paris Museum All are immature and apparently represent very early instars

OXYHALOINAE

KEY TO THE KNOWN GUIANAN SPECIES OF THE GENUS *Chorisoneura*[96] BRUNNER

A Size small for the genus, length of body including tegmina 8 to 10 mm Form slender (except *inversa*)
  B Pronotal disk without striking markings
    C Tegminal veins of same color as intervening areas
      D Head unicolorous
        E Form more graceful Size smaller, as small as *pusilla*. General coloration often darker *parishi* Rehn
        EE Form broader Size larger General coloration light ochraceous tawny
          F. Tegmina weakly suffused with area of costal veins

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[96] This key is intended purely as a preliminary aid in locating the Guianan species. It is of little value in distinguishing these from the multitude of exotic species of the genus.

scarcely paler Male styles very elongate, far surpassing supra-anal plate *stylata* new species.

FF Tegmina strongly suffused with area of costal veins distinctly paler. Male styles slightly surpassing supra-anal plate *fuscipennis* Hebard

DD Head with interocular bands.

E′ Head with not more than a single dark interocular band

F′ Head light ochraceous tawny, with a single narrow interocular band of dark brown, margined ventrad with buffy *galibi* new species

FF′ Head with vertex to between eyes ochraceous tawny, this terminated there in a very fine transverse line of mummy brown, other portions of face pale ochraceous buff

G Pronotal disk usually (probably always in life) slightly paler mesad, this area widening caudad Size small *barticae* Hebard

GG Pronotal disk uniform in color Size very small *pusilla* new species

EE′ Head with two whitish interocular bands, margined dorsad and ventrad and the interval between dark brown *gatunae* Hebard.

CC Tegminal veins strikingly pale (Form more graceful, the tegmina tapering to more sharply rounded apices)

D′ Head unicolorous (Pronotum narrowly paler cephalad and caudad of disk Tegminal veins not as conspicuously pale as in the two following species, as numerous as in *elegantula* Costal margin of tegmina as in *albonervosa*.) *wayana* new species

DD′. Head bicolored or with interocular bands.

E″ Head with vertex suffused, deepening to dark brown between eyes, this terminated in a transverse line; other portions of face whitish. Pronotum narrowly whitish laterad and caudad of disk Pale veins of tegmina more numerous Costal margin of wings strikingly whitish. *elegantula* new species

EE″ Head black, with a broad interocular band of white and below a narrow arc of the same Pronotum narrowly whitish cephalad and caudad of disk Pale veins of tegmina less numerous. Costal margin of wings not strikingly pale *albonervosa* Rehn.

BB. Pronotal disk light tawny, with a paler inverted V. (Head with two narrow whitish interocular bands, narrowly separated and very narrowly margined dorsad and ventrad with dark brown Form distinctly broader than in the preceding species.) *inversa* Hebard.[87]

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[87] It will be noted that this species is a small relative of forms, all of which run to section AA of the present key

AA. Size medium to large for the genus, length including tegmina 11 to 15 mm Form broad

B′. Size medium, Occiput with vertical streaks (Interocular space with two narrow transverse bands Tegmina with veins very narrowly but conspicuously pale) *strigifrons* new species

BB′ Size large. Occiput without vertical streaks

C Pronotal disk without a short pair of vertical lines

D Head and pronotum immaculate *splendida* new species

DD Head coloration (but not form) much as in *barticae* Pronotal disk weakly suffused and darkened laterad (Form very broad) *surinama* Saussure.

CC. Pronotal disk with a short pair of pale vertical lines. (Size and form much as in *surinama*)

D. Head with vertex to between eyes auburn, this sharply terminated there, other portions of face buffy *guianae* Hebard.

DD. Head ochraceous tawny with a pale interocular band, in which are located two widely separated and sometimes two more adjacent dots of dark brown *lata* Rehn.

Chorisoneura parishi Rehn

1918 *Chorisoneura parishi* Rehn, Proc. Acad. Nat Sci Phila., 1918, p. 163, pl I, figs. 19 to 21 [♂, Igarapé-Assú, Pará, Brasil]

St Jean du Maroni, French Guiana, 3 ♂, 4 ♀

Pariacabo, Kourou River, French Guiana, May, 1 ♀

Kourou River, French Guiana, July, 1 ♀

Roches de Kourou, French Guiana, 1 ♂

Passoura, French Guiana, February, July, 2 ♀.

La Forestière, upper Maroni River, French Guiana, May, 1 ♂

This entire series is so recessive in coloration that all trace of the pair of longitudinal pronotal suffusions, usual in *parishi*, have disappeared. All but two are pale ochraceous tawny in general coloration In all other features such close agreement with typical material is shown that we are convinced that these differences are all due to color variation Two males, from St Jean du Maroni and La Forestière, have the tegmina more elongate and are light buckthorn brown in general coloration. In no other feature do they differ, however, from the balance of the series The Anaplectoid contour of this insect is so distinctive that we feel that a Parishi Group should be recognized

The distribution of this species is now known to extend northwestward to Panama

Chorisoneura stylata new species Plate XVII, figure 1

This species is nearest *C fuscipennis* Hebard, belonging to the Flavipennis Group Though similar in most features, with head and pronotum pale and immaculate, males of *stylata* may be easily recognized by the exceedingly elongate and highly specialized styles

Type ♂, Bartica, British Guiana February 19, 1913 (H S Parish) [Acad Nat Sci Phila, Type no 5427]

Size and form much as in *fuscipennis*, large for the small species of the genus Interocular space about four-fifths that between antennal sockets Maxillary palpi with fifth joint slightly shorter than third, fourth about two-thirds as long as third Pronotum transverse, subelliptical, greatest width very slightly caudad of median point Tegmina surpassing subgenital plate by about half the pronotal length, reaching the apices of the extremely elongate styles, not broad for the genus, apices rather sharply rounded, costal veins (twelve to thirteen evident) straight, discoidal sectors (five distinct) moderately oblique, though not as strongly so as in the other groups of the genus Sixth dorsal abdominal tergite with a tuft of agglutinated hairs mesad, as is usual in *Chorisoneura* Supra-anal plate about one-third as long as proximal width, lateral margins concave convergent to the rather broad, sub-bilobate apex Subgenital plate with sinistral margin weakly concave and shorter dextral margin strongly concave to the styles, between which the plate is minutely triangularly produced dorsad, this surmounted by a minute decurved tooth Styles of the general type normal in *Chorisoneura*, but extraordinarily elongate and specialized, proximal portion three times as long as wide, the outer section rounding sharply distad, there with a small longitudinal ridge on its outer face, inside of this on its distal margin furnished with a microscopic, very briefly spined node, inner section narrow and transparent throughout, continued beyond outer section nearly one and one-half times length of the latter, these distal portions slender and curving feebly ventrad to their sharply rounded apices Limbs, their armament and pulvilli as characteristic of the genus. Arolia and tarsal claws as described for *C pusilla* on page 225

Allotype. ♀, Georgetown, British Guiana April 22, 1913 (H S Parish) [Acad Nat Sci Phila]

Agrees closely with male Individual probably depauperate as it is smaller Interocular space slightly less than width between antennal sockets Tegmina less ample and less elongate Subgenital plate ample, with a meso-distal longitudinal cleft

Head, disk of pronotum and dorsal surface of abdomen immaculate, light ochraceous tawny Antennae, limbs and ventral surface of abdomen slightly paler, the latter with caudal margins of the sternites narrowly whitish. Lateral portions of pronotum and tegmina translucent very faintly tinged with buckthorn brown, other portions of tegmina, when at rest, appearing uniform light ochraceous buff. Wings weakly tinged with ochraceous tawny, the area of the costal veins not strikingly paler.

The measurements of a paratypic male, bearing the same data, follow those of the type. Length of body ♂ 9.1 and 8.8, ♀ 8, length of pronotum ♂ 1.9 and 1.9, ♀ 1.8, width of pronotum ♂ 2.9 and 2.8, ♀ 2.7, length of tegmen ♂ 8.2 and 7.9, ♀ 6.8, width of tegmen ♂ 2.7 and 2.6, ♀ 2.2 mm.

Though not yet known from French Guiana, we have described *stylata* here, in order to avoid possible confusion with the related *fuscipennis*. Burmeister's *C. discoidalis*, described from Bahia, Brazil, is evidently very similar in general coloration. It is, however, probably a larger insect, four lines being given as the body length (the same as for the next species described, *Pseudomops intercepta*).

Chorisoneura fuscipennis Hebard.

1919. *Chorisoneura fuscipennis* Hebard, Mem. Amer. Ent. Soc., No. 4, p. 181, pl. VI, fig. 11. [♂, ♀; Porto Bello, Taboga Island and Cabima, Panama.]

St. Jean du Maroni, French Guiana, November, 1 ♂.

St. Laurent du Maroni, French Guiana, December, 1 ♀.

Roches de Kourou, French Guiana, 1 ♂.

These specimens agree with Panamanian material except that the antennae are entirely pale and the tegmina have the area of the clubbed portions of the costal veins as much paler than the surrounding portions only in the male from St. Jean.

The female has the ventral surface of the abdomen solidly opaque whitish buff, with meso-distal portion of the subgenital plate brown.

Larger series in good condition are needed to determine the number of species and degree of variation in each for this group.

Chorisoneura galibi new species. Plate XVII, figure 2.

This species closely resembles *C. flavipennis* Saussure and Zehntner in general form and coloration, differing in having the head not immaculate, the smaller size, slightly narrower interocular space and male styles which are proportionately larger and more elongate. The tegminal apiçes are more broadly rounded than in any of the other forms here recorded.

The marking of the head, pronotum and tegmina is of so great importance in distinguishing the species of *Chorisoneura*, that specimens, as a rule, can be more readily recognized from the color diagnosis than from the description of their structure Changes brought about in individuals through intensification or recession of color must, however, be expected in almost all color characters

Type · ♂, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1026]

Size small, form medium for the genus Head with interocular space slightly over three-quarters width between antennal sockets Maxillary palpi with fifth joint slightly shorter than third, fourth three-quarters as long as third Pronotum transverse, subelliptical, greatest width slightly caudad of median point, caudal margin transverse, feebly convex, cephalic margin slightly more convex; latero-cephalic angles distinctly more broadly rounded than the latero-caudal. Tegmina reaching almost to cercal apices, narrowing gradually to the rather broadly rounded apices, discoidal vein with (fifteen appreciable) costal veins, which are almost straight, discoidal sectors (eight distinct) oblique Subgenital plate small, reflexed at the brief, concave lateral margins, interval between styles very small, triangular, with no visible specialization Styles similar, large and elongate, compressed structures, external sections rounding distad with margin oblique to internal sections, at the juncture with those each armed with a small decurved spine, internal sections more elongate, delicate, with lateral margins parallel to the rounded apices. Limb armament, pulvilli, arolia and tarsal claws as apparently characteristic of the genus [88]

Head light ochraceous tawny, with a single narrow transverse band of dark chestnut brown between the eyes at point of least width, this margined ventrad with buffy [89] Antennae with proximal joints light ochraceous tawny, thence mummy brown paling distad Pronotum with disk immaculate, rich ochraceous tawny Tegmina transparent ochraceous tawny, toward the costal margin weakly tinged with the same, as are the lateral portions of the pronotum. Wings with area of costal veins showing a tinge of ochraceous tawny strongest Ventral surface of abdomen immaculate light ochraceous tawny, the limbs slightly paler.

The measurements of the male type are, length of body 7.8, length of pronotum 1.7, width of pronotum 2.7, length of tegmen 7 1, width of tegmen 2 1 mm

A female from Gourdonville, French Guiana, is before us which agrees closely with the type in all ambisexual features except size,

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[88] Described Mem. Amer Ent. Soc , No. 4, p. 132, (1919).

[89] The face appears discolored and may consequently, in life, have been largely buffy.

As the sexes of *Chorisoneura* are usually very similar, the females with shorter body and tegmina, we do not feel justified in placing this female as *galibi*, its length of body being 8 4 and the tegmen 8 2 mm

Chorisoneura barticae Hebard.

1921 *Chorisoneura barticae* Hebard, Proc Acad Nat Sci Phila, 1921, p 219, pl XIV, fig 13 [♂, ♀, Bartica and Demerara, British Guiana]

St Jean du Maroni, French Guiana, 1 ♂, 1 ♀

Nouveau Chantier, French Guiana, December, 1 ♂

Chorisoneura pusilla new species Plate XVII, figure 3

In smallness of size this insect is equalled only by *C parishi* Rehn of the forms known from the Guianas

It is closely related to *C barticae* Hebard, differing only in the decidedly smaller size, uniformly colored pronotal disk, wider interocular space, less sharply rounded tegminal apices and longer male styles.

Type ♂, Nouveau Chantier, French Guiana June [Hebard Collection, Type no 1032]

Size very small and form moderately slender for the genus. Interocular width four-fifths that between the antennal sockets Maxillary palpi with fifth joint longer than third, fourth joint decidedly shorter Pronotum transverse, but not as strongly so as in *barticae*, subelliptical, greatest width meso-caudad, cephalic and caudal margins transverse, very feebly convex; latero-cephalic angles distinctly more broadly rounded than the latero-caudal Tegmina slightly surpassing apices of cerci, comparatively narrow for the genus, apices rounded but not nearly as sharply as in *barticae;* veins very delicate, costal veins regular, discoidal sectors oblique[100] Dorsal surface of abdomen with sixth tergite weakly specialized mesad, as is characteristic of the genus Supra-anal plate weakly triangularly produced with apex broadly rounded Subgenital plate with lateral portions oblique, median portion very weakly triangularly produced, its dorsal surface apparently armed internally with a blunt, recurved, chitinous tooth[101] Styles nearly three times as long as greatest width, offset of lateral margins (apices of external portions of styles) indicated though broadly rounded, remaining apical portions narrow, lamellate, with apices rounded. Limbs, their armament and pulvilli as characteristic of the genus Large arolia present and surpassing the apex of the shorter of the asymmetrical tarsal claws

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[100] The wings can not be examined, due to the fragility of the material, which is not in good condition.

[101] In many individuals this would probably not be visible without dissection Similar specialization may, therefore, occur in *barticae*.

Allotype ♀, Roches de Kourou, French Guiana [Hebard Collection]

Agrees very closely with male, except as follows Interocular space slightly less than width between antennal sockets. Tegmina less ample and less elongate Subgenital plate large, with a mediolongitudinal distal cleft

Head with occiput to between ocellar areas ochraceous tawny, this deepened to prouts brown there and terminated in a transverse line, below which the face is opaque ochraceous buff.[108] Antennae with proximal two joints and mouthparts weakly tinged with translucent ochraceous buff, the antennae thence mummy brown paling again to the basal coloration distad. Pronotum laterad and costal margins of tegmina transparent, very faintly tinged with ochraceous buff, pronotal disk uniform weak buckthorn brown, with a faint tawny tinge Tegmina transparent, when closed appearing weakly and evenly tinged with ochraceous tawny in all but lateral marginal portions Limbs transparent ochraceous buff Ventral surface much the same, except abdomen which, in life, was evidently overlaid with whitish

The measurements of the male type are followed by those of a paratypic male, bearing the same data as the female allotype Length of body ♂ 6 7 and 6 7, ♀ 6 8, length of pronotum ♂ 1 6 and 1 7, ♀ 1 7, width of pronotum ♂ 2 3 and 2 4, ♀ 2 3; length of tegmen ♂ 6 8 and 6 8, ♀ 6.4, width of tegmen ♂ 2 and 2, ♀ 2 mm

Chorisoneura gatunae Hebard.

1921. *Chorisoneura gatunae* Hebard, Ent. News, XXXII, p 167, pl. III, figs. 3 and 4. [♂, Gatun, Canal Zone, Panama.]

St. Jean du Maroni, French Guiana, September, 2 ♂

These specimens agree closely with the type, which was previously unique

Chorisoneura wayana new species. Plate XVII, figure 4

This insect is of the same general form as *C elegantula* here described and *C albonervosa* Rehn, agreeing with both also in having short male styles and with *albonervosa* in size The pronotal coloration agrees better with that insect, that of the tegmina with *elegantula*, but the pale markings are finer and weaker than in those species. The pale and unicolorous head is the most striking feature of difference from both.

Type ♂; St. Jean du Maroni, French Guiana. November, [Hebard Collection, Type no. 1033]

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[108] The opaque whitish or buffy face and ventral surface of the abdomen largely, if not entirely, disappears in material of the genus which has been poorly dried. Such has occurred to some extent in the present type.

Size slightly under medium for the genus, form intermediate between the narrow and broad species, but with tegmina tapering to the sharply rounded apices as in the latter forms Head with interocular space three-quarters width between antennal sockets, wider than in *elegantula* or *albonervosa* Maxillary palpi with fifth joint three-quarters as long as third, fourth as long as fifth Pronotum transverse, subelliptical, greatest width mesad, latero-cephalic angles as broadly rounded as the latero-caudal, cephalic margin with distinct convexity above the head Tegmina surpassing supra-anal plate by nearly pronotal width, moderately broad proximad, tapering evenly to the sharply rounded apices, costal veins (nineteen) regular, but slightly sinuous proximad, discoidal sectors (ten, including two short distal branches of the discoidal vein) moderately oblique Supra-anal plate weakly triangularly produced with apex broadly rounded Subgenital plate with brief lateral margins concave to the styles, between which the distal margin forms a small triangle with apex produced in a decurved tooth Styles irregularly rounded trigonal, scarcely twice as long as basal width Abdomen, limbs, their armament and pulvilli as characteristic of the genus Arolia reaching as far as apex of shortest of the asymmetrical tarsal claws

Head uniform ochraceous tawny, entirely opaque Antennae with two proximal joints buckthorn brown, other portions and eyes blackish Limbs ochraceous buff Ventral surface of abdomen and cerci uniform light ochraceous tawny Pronotum with disk tawny, paling to ochraceous tawny meso-caudad, margined cephalad and caudad with buffy Lateral portions of pronotum and tegmina transparent ochraceous tawny, the veins so finely ochraceous buff that this can scarcely be detected with the naked eye There are five such veins in the anal field (six in *elegantula*, four or only three dextrad in *albonervosa*) Wings tinged with ochraceous tawny, this approaching ochraceous buff in area of enlarged portions of costal veins

The measurements of a male paratype, from Charvein, French Guiana, taken in November, follow those of the male type Length of body 9 1 and 8 8, length of pronotum 2 1 and 2, width of pronotum 2 9 and 2 9, length of tegmen 8 9 and 8 7, width of tegmen 2 8 and 2.8 mm

Chorisoneura elegantula new species. Plate XVII, figure 5.

This species is nearest the preceding, *C wayana*, under which comparisons are made It has somewhat longer organs of flight and the pale markings about the pronotal disk are differently arranged The pale tegminal veins are as conspicuous as in *C albonervosa* Rehn, but more numerous and less heavy

Type ♂, St Jean du Maroni, French Guiana January. [Hebard Collection, Type no 1034]

Size medium for the genus, form as described for *wayana* on page 227 Head with interocular space three-fifths as wide as width between antennal sockets, as in *albonervosa* Maxillary palpi elongate, fifth joint slightly shorter than fourth, fourth four-fifths as long as third Pronotum and tegmina as described for *wayana;* tegmina with costal veins (nineteen evident) regular but slightly sinuous proximad, sinistral tegmen damaged, dextral with (fourteen) oblique discoidal veins, these decidedly more oblique than in *albonervosa* Supra-anal plate weakly produced, weakly bilobate distad Subgenital plate and cerci much as described for *wayana,* except that the brief lateral margins of the former are strongly concave Abdomen, limbs, their armament and pulvilli as characteristic of the genus Arolia reaching as far as apex of shortest of the asymmetrical tarsal claws

Head with occiput ochraceous buff tinged with tawny, deepening to chestnut brown between eyes and there mesad terminating in a straight, transverse line, other portions of face opaque light ochraceous buff Limbs and palpi translucent light ochraceous buff Ventral surface of abdomen ochraceous buff deepening to ochraceous tawny laterad, each tergite broadly suffused with opaque whitish latero-caudad. Pronotum with disk and cephalic portion to cephalic margin chestnut brown paling medio-longitudinally to hazel caudad, lateral and caudal portions of this dark area margined with opaque whitish Remaining lateral portions of pronotum and corresponding margins of tegmina transparent and almost colorless Tegmina elsewhere transparent chestnut brown, the numerous veins (except in area of dextral tegmen, concealed when at rest, where they are chestnut brown) very finely but conspicuously white Wings transparent chestnut brown, the costal margin to near base broadly opaque, white.

The unique male type measures as follows Length of body 9 2, length of pronotum 2, width of pronotum 3, length of tegmen 9 3, width of tegmen 3 mm

Chorisoneura albonervosa Rehn.

1916 *Chorisoneura albonervosa* Rehn, Trans Amer Ent Soc, XLII, p. 255, pl XIV, figs 21 and 22 [♂. Pará, Pará, Brasil]

St Jean du Maroni, French Guiana, 2 ♂, 2 ♀

Passoura, French Guiana, October, 1 ♀

Roches de Kourou, French Guiana, 2 ♀

Intensification and recession of coloration clearly cause decided individual difference in the general appearance of this magnificent species. Three females are almost as pale as the type, the others darker to different degrees, the pronotal disk showing this particularly, as follows. In one it is burnt sienna suffused with deep bay on each side, in one solidly deep bay, and in two black, showing very faintly a tinge of bay.

The striking cephalic and marginal pronotal markings and outstandingly pale tegminal veins are, however, the same in all

Chorisoneura inversa new species. Plate XVII, figure 6

This insect is readily recognized by the pale and well defined inverted V on the pronotal disk It is not related to the preceding forms, being of the broader type found in *C lata* Rehn and its allies, though a much smaller insect The pronotal marking is also apparently an amplification of the pair of shorter convergent pale homologous lines shown by *lata*

Type ♀, St Jean du Maroni, French Guiana [Hebard Collection, Type no 1028]

Size small and form broad for the genus Head with vertex decidedly flattened and not rounding gradually into the flattened face, but with an intervening band between the eyes (occupied by bands of color) flattened convex, width between eyes very slightly less than that between antennal sockets Eyes strongly protruding, dorsal portions vertically narrow Maxillary palpi as in *C galibi* described on page 224 Pronotum strongly transverse, subelliptical, greatest width mesad, latero-cephalic angles slightly more broadly rounded than the latero-caudal Tegmina extending beyond apex of abdomen, their apices sharply rounded, marginal fields broad as are lateral portions of pronotum, discoidal vein with (fifteen) costal veins, which proximad are curved, discoidal sectors (thirteen to fifteen, four being formed by ulnar vein) oblique Supra-anal plate triangular with apex narrowly and decidedly bilobate, the dorsal surfaces of the bilobate portion strongly convex Subgenital plate large, distal portion reflexed and medio-longitudinally cleft to its base Limbs damaged, their armament, pulvilli, arolia and tarsal claws apparently as characteristic of the genus

Allotype· ♂, Nouveau Chantier, French Guiana October [Hebard Collection]

This sex agrees closely with the female, differing as follows Body form more slender, though pronotum and tegmina are broad, the latter more ample and elongate Width between eyes slightly less Apex of abdomen crushed Styles short, not over twice as long as proximal width, separated by a rather large triangular projection of the median portion of the subgenital plate, a very small and slender, apparently bidentate, chitinous shaft projecting from this dextrad.

Head with occiput translucent ochraceous buff tinged with tawny, face translucent ochraceous buff tinged with buckthorn brown; broad interocular ridge with two narrow transverse bands of whitish, the ventral slightly the wider, separated by a band of blackish brown no wider than the dorsal, the pale bands narrowly continued along the margins of the eyes and in interocular area very narrowly margined toward occiput and face with blackish brown Limbs translucent ochraceous buff tinged with buckthorn brown Ventral surface of abdomen similar, but all except disto-median portion of subgenital plate more opaque and buffy, in the male with the sternites transversely suffused with white mesad Pronotum with disk apricot orange, with a delicate inverted V (rather U-shaped in the allotype) of light buff, which fails to reach the cephalic and caudal margins of the disk by a brief interval, lateral portions clear hyaline, a faint suffusion of whitish along the caudal margin Tegmina transparent tinged with ochraceous tawny, becoming clear hyaline toward the costal margin, the veins very finely defined in whitish

The measurements of paratypes follow those of the type and allotype Length of body ♂ 8 2 and 7 2, ♀ 7 8 and 7 1, length of pronotum ♂ 1 9 and 1 8, ♀ 1 75 and 1 8; width of pronotum ♂ 3 1 and 3 1, ♀ 3 and 3 05, length of tegmen ♂ 8.2 and 7 8, ♀ 7 and 7 2, width of tegmen ♂ 2 7 and 2 6, ♀ 2 4 and 2 4 mm

Specimens Examined 6, 4 males and 2 females

Kartabo, British Guiana, (Wm Beebe), 1 ♂, *paratype*, [Acad Nat Sci Phila]

St Jean du Maroni, French Guiana, 2 ♀, *type* and *paratype*

St Laurent du Maroni, French Guiana, August, 1 ♂, *paratype*

Nouveau Chantier, French Guiana, October, December, 2 ♂, *paratypes*

Chorisoneura strigifrons new species Plate XVII, figures 7 and 8.

This species may be easily recognized by its vertically striped vertex It is related to the preceding species but larger, with ridge between occiput and face even more pronounced, interocular space narrower, pronotal marking distinctive and pale tegminal veins more conspicuous

Though *inversa* here described and *strigifrons* are very distinct, they are decidedly more closely related to each other than to *C. lata* Rehn and its allies

Type ♀, St Jean du Maroni, French Guiana [Hebard Collection, Type no. 1027]

Size medium, form broad for the genus. Head with broad interocular ridge even more distinct than in *inversa*, due to the face being impressed before it; interocular space very slightly over two-thirds width between antennal sockets. Eyes strongly protruding, dorsal portions vertically narrow. Maxillary palpi as in *C. galibi* described on page 224 Pronotum very strongly transverse, greatest width mesad, latero-cephalic angles more broadly rounded than the latero-caudal Tegmina extending to apices of cerci, their apices sharply rounded, marginal field decidedly broad, as are lateral portions of pronotum, discoidal vein with (seventeen to nineteen) costal veins, which proximad are curved, discoidal sectors (fifteen to seventeen, three to five being formed by ulnar vein) oblique Supra-anal and subgenital plates much as described for *inversa* on page 229 Limb armament, pulvilli, arolia and tarsal claws as characteristic of the genus

Head with occiput translucent ochraceous buff tinged with tawny, vertically and irregularly striped with light buff between the eyes, the narrow intervals there more tawny, this terminated in a narrow transverse interocular line of light buff, with briefly below this a similar line which is interrupted mesad but continued very narrowly along the ventral margin of the eyes to the ocellar spots, interval between these pale lines and all of face translucent ochraceous buff feebly tinged with ochraceous tawny Limbs translucent ochraceous buff, adjacent lateral portions of thorax mars brown Abdomen ochraceous buff feebly tinged with ochraceous tawny, except broadly along caudal margin of sternites, subgenital plate suffused distad with mars brown Pronotal disk apricot orange, with a delicate pair of light buff lines, convergent cephalad, which fail to reach the cephalic and caudal margins of the disk by a brief interval; cephalad these lines are narrowly separated, meso-caudad each has a sudden deeply rounded but very small invasion of the ground color on its inner margin, lateral portions clear hyaline, caudal margin narrowly prouts brown, this extending around the latero-caudal angles Tegmina translucent mummy brown, becoming clear hyaline toward the costal margins, the veins very finely but conspicuously defined in whitish Wings suffused with mummy brown, buffy along the costal margins

The measurements of a paratypic female, bearing the same data, follow those of the type female Length of body 10 and 9 3, length of pronotum 2 3 and 2 2, width of pronotum 3 8 and 3 8, length of tegmen 8.9 and 8 8, width of tegmen 3 2 and 3 3 mm

Chorisoneura splendida new species. Plate XVII, figures 9 and 10

The large size, bright coloration, strikingly yellow discoidal and median veins of the tegmina and immaculate head and pronotal disk, make this one of the most distinctive species of the genus

Though not of very close affinity, this species shares with *C surinama* Saussure greater size and breadth than is found in any other of the known forms

Type ♂; Kartabo, Bartica District, British Guiana February 22, 1922 (Wm Beebe.) [Acad. Nat Sci Phila., Type no. 5426]

Size very large and form very broad for the genus Head with interocular-ocellar area somewhat impressed, its dorsal margin (often) delimited by a weakly defined, transverse ridge; interocular space three-quarters width between antennal sockets Maxillary palpi with fifth joint subequal in length to fourth, three-quarters as long as third Pronotum strongly transverse, rectangulato-elliptical, greatest width mesad, cephalic margin weakly convex above head, caudal margin transverse, very broadly and feebly convex, latero-cephalic angles as broadly rounded as the latero-caudal Tegmina reaching well beyond cercal apices, narrowing to their sharply rounded extremities, marginal fields very broad, discoidal vein with (seventeen to nineteen apparent) costal veins, which are straight and regular, discoidal sectors (twelve to fourteen distinct), oblique and quite regular[103] Subgenital plate small, styles elongate, gradually narrowing without lateral offset to the sharply rounded apices, showing no striking specialization but with proximo-lateral portions somewhat bulbous Median portion of subgenital plate produced in a minute erect spine between the cercal bases Limb armament, pulvilli, tarsal claws and arolia as characteristic of the genus[104]

Head with face and occiput ochraceous buff tinged with orange, the latter sometimes deepening to ochraceous tawny at its margin formed by the weak ridge delimiting the interocular-ocellar area dorsad Antennae with two proximal joints ochraceous buff tinged with orange, thence mummy brown, paling distad to weak buckthorn brown Limbs, cerci and ventral surface ochraceous buff, the abdomen tinged with orange Pronotum with disc ochraceous orange, occasionally vaguely and weakly more buffy above head and latero-caudad, lateral portions and broad marginal and costal fields of tegmina clear hyaline, transparent, the former alone weakly tinged with reddish brown caudad. Other portions of tegmina transparent tinged with ochraceous orange, except discoidal vein and over proximal half of median vein, which are opaque antimony yellow, apices of tegmina suffused with russet Wings tinged with ochraceous tawny.

The two opaque antimony yellow tegminal veins, which fuse proximad, afford a most distinctive feature not known in any other species of *Chorisoneura*, and one which is still apparent in several greatly discolored specimens before us.

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[103] The ulnar vein forms one of these, occasionally branching to form two, while the discoidal vein distad sends one or two branches to the sutural margin which often again branch, thus forming sometimes as many as four of the least conspicuous distal discoidal sectors.

[104] Described Mem Amer Ent Soc , No. 4, p. 132, (1919)

Measurements (in millimeters)

♂		Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Kartabo.	*Type*	11 8	2 9	4 4	12 1	4 1
Kartabo.	*Paratype*	11	2 9	4 6	12 3	4 4
St Jean	*Paratype*	10 2	2 7	4 3	11 3	3 8
St Jean.	*Paratype*	11	3	4 4	11 5	4

Specimens Examined 7, 7 males

Kartabo, Bartica District, British Guiana, 2 ♂, *paratypes*, February 22, 1922, 1 ♂, *type*, (all Wm Beebe), [all Acad Nat Sci Phila]

St Jean du Maroni, French Guiana, June, 3 ♂, *paratypes*

Nouveau Chantier, French Guiana, May, 1 ♂, *paratype*

Chorisoneura surinama Saussure

1868 *Chorisoneura surinama* Saussure, Rev. et Mag. de Zool , (2), XX, p 100 [(♂], Surinam[105] (= Dutch Guiana)]

Saussure's discussion, in 1870, of his *C multinervosa*, described from tropical America in 1869, is puzzling The specimen was from the Paris Museum and so very possibly came from French Guiana The head is said to be unmarked, but the description otherwise fits *surinama* very well It is therefore possible that *multinervosa* may prove to be a synonym of *surinama*, based on a much discolored specimen

St Jean du Maroni, French Guiana, 3 ♀, 4 juv ♀

Nouveau Chantier, French Guiana, December, 1 ♂

This is not only the largest but also the broadest and most deplanate described species of the genus Its structure is delicate in the extreme The dark interocular band lies on the rather sharply rounded ridge separating the face and occiput It is very decided in the male, but very narrow with dorsal margin vague in the females before us. The face, in specimens which have not become discolored, is opaque, clear warm buff, as is all the ventral surface of the abdomen except the subgenital plate meso-distad

The present male is apparently depauperate, as indicated by comparison with the measurements of one of the females here recorded. Length of body ♂ 12, ♀ 13, length of pronotum ♂ 3, ♀ 3 2; width of pronotum ♂ 4 2, ♀ 5 2, length of tegmen ♂ 11, ♀ 12 3, width of tegmen ♂ 3 8, ♀ 4 1 mm

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[105] Saussure's more detailed description of this insect, in 1870, gives 23 mm as the tegminal length. This is almost certainly in error for 13 mm.

Chorisoneura guianae Hebard

1921 *Chorisoneura guianae* Hebard, Proc. Acad Nat Sci Phila., 1921, p 217, pl XIV, figs. 11 and 12. [♂, ♀ Bartica, British Guiana; Cayenne (= French Guiana)]

Nouveau Chantier, French Guiana, January, 1 ♂

Roches de Kourou, French Guiana, 2 ♂

This species, *C panamae* Hebard and *C lata* Rehn, have the convexity of the latero-cephalic angles of the pronotum as great as that of the latero-caudal Agreement in other important features shows that they belong to the same group

Chorisoneura lata Rehn.

1916 *Chorisoneura lata* Rehn, Trans. Amer Ent Soc, XLII, p 253, pl XV, figs. 28 to 30 [♂; Pará, Pará, Brasil]

St Jean du Maroni, French Guiana, 1 ♂, 1 ♀

These specimens are little discolored (as is the type), but the male, like the type, lacks the smaller and more adjacent pair of dots between the eyes, though minute impressions are there indicated. The female is like the female recorded by us from Gourdonville, French Guiana [106]

The comparison with the closely related *C. panamae* Hebard should have read, "this cephalic marking (as found in *lata*) is seen to differ principally in having the more widely separated pair of dots the larger and the pale areas confined to a transverse band instead of spreading ventrad over the face "

Unfortunately, in comparing *panamae* with *lata*, the male styles of the type of the latter species were not seen to be damaged These organs are actually the longer in *lata* Moreover, the margins of the pronotal disk and principal veins of the tegmina show scarcely any whitish, a condition weakly but distinctly indicated in *panamae*

Plectoptera pulicaria Saussure and Zehntner

1893 *Plectoptera pulicaria* Saussure and Zehntner, Biol Cent.-Amer. Orth, I, p 86, pl III, fig. 8 [Bugaba, Panama.]

St Jean du Maroni, French Guiana, 2 ♂, 1 ♀

These specimens agree closely with the original description and a female from Turrialba, Costa Rica, in the Academy Collection, except in being decidedly darker.

The pronotal disk and ground color of the tegmina is deep shining carob brown The tegmina, except in the anal field and for a brief distance beyond around its apex, are microscopically vermiculate with white These markings form longitudinal lines proximad and beyond vague spots occur which, to the naked eye, produce a somewhat mottled appearance The marginal field of the tegmina is transparent with numerous flecks of the darker coloration

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[106] Proc Acad Nat Sci Phila, 1921, p 217, (1921)

PERISPHAERINAE

Proscratea complanata (Perty) Plate XVII, fig 11

1830 *Blatta complanata* Perty, Delect Anim Art, p 116, pl 23, fig 1. [In mountains of Minas [Geraes], Brazil]

1838. *P[roscratea] funebris* Burmeister, Handb Ent, II, Abth. II, pt. I, p. 509 [Cameta, Brasil]

Saussure's *peruana* has already been placed in the present synonymy There is no doubt that Burmeister was misled by brachypterous material and described such as *funebris*

St Jean du Maroni, French Guiana, 1 ♀, brachypterous

Nouveau Chantier, French Guiana, 1 ♀, macropterous

The measurements of these females are as follows Length of body 14 7 and 17, length of pronotum 3 3 and 3 8, width of pronotum 5 4 and 6 2, length of tegmen 9 1 and 14 8, width of tegmen 3 4 and 4 9 mm

Saussure's generic diagnosis for *Proscratea*[107] is much of the best, which genus is now found to include only a single species

Though very distinct, we feel that *Proscratea* certainly belongs to that section of the subfamily which includes *Paranauphoeta* Brunner and its allies

In *Proscratea* the pronotum, though more flattened, is more suddenly decurved along the lateral margins of the disc, with its narrow lateral portions nearly horizontal and the lateral margins cingulate and weakly reflexed The ventral femoral margins show characters of value which have not been described All are unarmed except as follows of cephalic femora each with a small, heavy distal spine, that of the ventro-cephalic margin preceded by a series of minute chaetiform spines; ventro-caudal of caudal femora with two small, heavy spines The arolia are small but distinct

In *Paranauphoeta* the distal spine of the ventro-cephalic margin of the cephalic femora and the spines of the ventro-caudal margin of the caudal femora are lacking That genus has the pronotum slightly less flattened and curving gradually to the lateral margins which are not cingulate, while the arolia are reduced to mere nodes

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[107] Mém. l'Hist Nat Mexique, Blatt, p 205, (1864). The colored figure, plate II, fig. 32, is excellent, except that the pale portions of the insect are actually light ochraceous buff and therefore decidedly less yellow

GALIBLATTA new genus

This genus belongs to that section of the Perisphaerinae showing Epilamprine tendencies and is apparently nearest *Colapteroblatta* Hebard

In *Galiblatta*, however, the pronotal contour is the same in the sexes and both are heavily chitinous The coriaceous tegmina of the males extend to the end of the abdomen and are very broadly rounded distad, while those of the females are very abbreviate and much as in *Colapteroblatta compsa* Hebard The presence of two heavy distal spines on the ventro-cephalic margins of the cephalic femora and numerous rugae at the caudal margins of the abdominal tergites in the females show even greater resemblance to species of the Epilamprinae than does that species, but this and all of the related genera are quickly separable from any of that subfamily by the tarsal joints which are entirely unarmed ventrad

The single species, *G. cribrosa*, shows the following characters of apparent generic value Form of pronotum similar in the sexes, female longer and much broader than male Head with vertex exposed and rounded, interocular space wide, ocellar spots small and vague in male, even less distinct in female[108] Pronotum thickly impresso-punctulate, convex and embracing head, disk more raised and rounding into the narrow, oblique lateral portions, the margins of which are cingulate, caudal margin very broadly convex Tegmina coriaceous, with surface thickly impresso-punctulate in both sexes, little reduced, the apices broadly rounded in male, abbreviate in female Wings little reduced in male, represented by small, atrophied pads in female Supra-anal plate bilobate and subchitinous in male, weakly emarginate mesad and chitinous in female Subgenital plate of characteristic Blaberine type, asymmetrically rounded with partially or wholly atrophied styles in male, simple, ample, fitting closely all of ventral portion of abdomen beyond fifth tergite in female Limbs moderately heavy, longer than in *Colapteroblatta* Ventro-cephalic margin of cephalic femora armed with a row of chaetiform spines, terminating in two heavy, elongate distal spines, ventro-caudal margin armed with a single, short, heavy distal spine. Ventral margins of median and caudal femora each supplied with a few short, heavy spines, the ventro-caudal margin of the caudal femora alone lacking a distal spine Caudal metatarsus no longer than combined length of the three succeeding joints, the four proximal joints with ventral surfaces unarmed and all fully occupied by large pulvilli, which are bluntly angulate produced distad, that of the metatarsus linear in proximal portion. Large arolia present between the simple, symmetrical tarsal claws.

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[108] We have frequently observed that, in the Blattidae, reduction in the organs of flight is almost always accompanied by like reduction in the ocellar spots.

Galiblatta cribrosa new species. Plate XVII, figures 12 and 13.

This insect may be distinguished from its nearest allies by the coriaceous and uniform dark tegmina in the male and by the numerous rugae at the caudal margins of the abdominal tergites in the female.

Type. ♂, St. Jean du Maroni, French Guiana. [Hebard Collection, Type no. 1029.]

Size medium for the group, form moderately broad. Head smooth except for scattered impressed punctae in the flattened interocular-ocellar area. Eyes feebly projecting, occipital ocular depth three-fifths width of interocular space, which is three-quarters width between antennal sockets. Maxillary palpi moderately heavy, fifth joint slightly longer than third, fourth four-fifths as long as third. Pronotum, tegmina and wings as given in generic description. Sulci of pronotal disk absent. Tegmina with venation visible only in certain lights. Wings with (two) incomplete and (three) complete branches of the ulnar vein, intercalated triangle very elongate and narrow. Dorsal surface of abdomen weakly chitinous, latero-caudal angles of tergites rounding bluntly into their transverse caudal margins. Supra-anal plate with breadth about twice length, bilobate distad, with lateral margins broadly convex convergent. Cerci stout, projecting as far as supra-anal plate. Subgenital plate rounded and produced sinistrad more than dextrad, a narrow elongate subchitinous area along each lateral margin, that dextrad the more proximal and springing from it alone is a simple, straight, cylindrical style, slightly over four times as long as broad.[109] Other characters as given in the generic description.

Allotype. ♀; same data as type. [Hebard Collection.]

Size larger, form much broader than male. Eyes not projecting, occipital ocular depth slightly over two-fifths interocular width, which is very slightly greater than width between antennal sockets. Pronotum of same contour as male, the latero-caudal angles differing in being rectangulate and sharply rounded, so that the caudal margin is very weakly convex in greater portion but is straight and transverse briefly at its extremities. Tegmina represented by attingent pads, roundly produced laterad with apices reaching the median segment, their caudal margins forming together a large, symmetrically trapezoidal, rounded emargination, so that the median straight portion of their caudal margins lies just beyond the caudal margin of the mesonotum. In general character the tegmina are very much as in this sex of *Colapteroblatta compsa*, though the

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[109] In the paratypic male this style is absent, as is the sinistral style in both males. This is apparently due to atrophy.

reduction mesad is greater in the present insect Dorsal surface everywhere finely and thickly impresso-punctulate, these transforming into minute tubercles distad on abdomen, abdomen with numerous minute longitudinal rounded rugae at caudal margins of median segment and tergites (thirteen is the maximum number on one tergite), these weak but distinct Cerci very small, broad, with lateral margins entire and apex acute Subgenital plate with free margin rather strongly concave emarginate below cerci, the broad median portion thence briefly produced with margin convex but truncate mesad Other characters as given in the generic description

Male Dorsal surface shining deep chestnut brown, the portion of the dextral tegmen, concealed when at rest, becoming transparent hazel Pronotum with a very small and inconspicuous suffused area of dull ochraceous buff on cephalic margin on each side of head Dorsal surface of mesonotum, metanotum and abdomen ochraceous buff, tinged with chestnut brown distad Wings clear hyaline, area of branches of ulnar vein and costal margin broadly and more strongly tinged with tawny Head, ventral surface and limbs chestnut brown, the former with occiput and mouthparts dull ochraceous buff

Female. Shining deep chestnut brown, the occiput, minute latero-cephalic areas on pronotum, mouthparts and tips of cerci buffy Dorsal surface of abdomen with a very faint, broad mesolateral and distal marbling of ochraceous tawny, giving the appearance of decayed wood This is indistinct, but apparently a constant feature of coloration

The paratypic male before us was apparently teneral when killed, as it is much paler in general coloration

The measurements of type and allotype are followed by those of paratypes which bear the same data Length of body ♂ 20 3 and 19 7, ♀ 23 9 and 23 1, length of pronotum ♂ 5 7 and 5 8, ♀ 7 1 and 6 7, width of pronotum ♂ 7 8[110] and 7, ♀ 9 8 and 9 9; length of tegmen ♂ 15 3 and 15 3, ♀ (greatest exposed, lateral) 5 3 and 4 9, width of tegmen ♂ 6 and 5 9, ♀ 7 and 6 8, length of caudal femur ♂ 5 7 and 5 7, ♀ 7 2 and 6 7, width of abdomen ♂ 8 3 and 8 6, ♀ 13 and 12[111] mm

Specimens Examined 14, 2 males, 4 females and 8 immature individuals

St Jean du Maroni, French Guiana, 2 ♂, 4 ♀, *type, allotype, paratypes*, 1 juv ♂, 6 juv. ♀

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[110] Probably slightly crushed.

[111] In another female, in which the surfaces of the abdomen are both much more convex, the greatest width is 11 2 mm. This dimension naturally varies with the abdominal content

St Laurent du Maroni, French Guiana, November, 1 juv. ♂

The number of species here considered is such that we feel it advisable to give the page on which each is treated, for the convenience of the student Those here described as new are preceded by an asterisk

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EXPLANATION OF PLATES XII TO XVII

PLATE XII —Fig. 1 —*Lissoblatta orientis* new species Male *Type* St Jean du Maroni, French Guiana Ventral view of apex of subgenital plate (Greatly enlarged)

Fig 2 —*Lissoblatta stylata* new species Male *Type* St Jean du Maroni, French Guiana. Ventral view of apex of subgenital plate (Same scale as Fig. 1)

Fig. 3.—*Anaplecta subsignata* new species. Male *Type.* Nouveau Chantier, French Guiana. Ventral view of subgenital plate. (Much enlarged)

Fig 4 —*Anaplecta subsignata* new species. Female. *Allotype.* Nouveau Chantier, French Guiana Dorsal view (× 7)

Fig. 5 —*Anaplecta insignis* new species. Female. *Type.* Nouveau Chantier, French Guiana. Dorsal view (× 7)

Fig 6 —*Anaplecta suffusa* new species. Male *Type* St. Laurent du Maroni, French Guiana. Dorsal view of pronotum. (× 10½)

Fig 7 —*Anaplecta suffusa* new species. Male *Type.* St Laurent du Maroni, French Guiana. Ventral view of subgenital plate (Same scale as Fig. 3)

Fig. 8 —*Anaplecta pluto* new species. Female *Type* Nouveau Chantier, French Guiana. Dorsal outline of tegmen, to show venation. (× 7)

Fig. 9 —*Anaplecta poecila* new species Female *Type* La Forestière, French Guiana Dorsal view (× 7)

Fig. 10 —*Dendroblatta insignis* new species Female *Type* Godebert-Maroni, French Guiana. Dorsal view (× 3)

Fig 11 —*Dendroblatta cnephaia* new species. Male *Type* Nouveau Chantier, French Guiana. Dorsal view of pronotum. (× 5.)

Fig 12 —*Dendroblatta cnephaia* new species Male *Type* Nouveau Chantier, French Guiana Ventral view of subgenital plate (Much enlarged.)

Fig. 13 —*Eudromiella chopardi* new species. Male *Type* St. Jean du Maroni, French Guiana. Dorsal view (× 3½)

Fig 14 —*Eudromiella chopardi* new species. Male *Type.* St. Jean du Maroni, French Guiana. Caudal view of subgenital plate (Much enlarged)

Fig. 15.—*Eudromiella chopardi* new species. Male *Type* St Jean du Maroni, French Guiana Dextro-mesal process of subgenital plate as seen from a dextro-lateral point (Much enlarged)

Fig. 16 —*Eudromiella maroni* new species Male. *Type* Nouveau Chantier, French Guiana. Dorsal view. (× 3½)

Fig. 17 —*Eudromiella maroni* new species. Male *Type.* Nouveau Chantier, French Guiana. Caudal view of subgenital plate. (Same scale as Fig. 14)

Fig. 18.—*Macrophyllodromia nigrigena* new species. Male *Type.* St. Jean du Maroni, French Guiana. Doral view. (× 2½.)

Fig. 19 —*Macrophyllodromia nigrigena* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventro-caudal view of distal portion of subgenital plate (Much enlarged.)

PLATE XIII.—Fig. 1.—*Eudromiella inexpectata* (Rehn). Male. St. Jean du Maroni, French Guiana. Caudal view of subgenital plate. (Same scale as Pl. XII, fig. 14.)

Fig. 2.—*Eudromiella inexpectata* (Rehn). Male. St. Jean du Maroni, French Guiana. Dextro-mesal process of subgenital plate, as seen from a dextro-lateral point. (Same scale as Fig. 1.)

Fig. 3.—*Neoblattella nodipennis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Lateral view of subgenital plate. (Much enlarged.)

Fig. 4.—*Neoblattella nodipennis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 3.)

Fig. 5.—*Neoblattella nodipennis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Caudal view of subgenital plate. (Same scale as Fig. 3.)

Fig. 6.—*Neoblattella titania* (Rehn). Male. St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged.)

Fig. 7.—*Neoblattella litosoma* new species. Male. *Type.* Nouveau Chantier, French Guiana. Dorsal view of pronotum. (× 7½.)

Fig. 8.—*Neoblattella litosoma* new species. Male. *Type.* Nouveau Chantier, French Guiana. Lateral view of subgenital plate. (Much enlarged.)

Fig. 9.—*Neoblattella poecilops* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Cephalic view of head. (× 7½.)

Fig. 10.—*Neoblattella poecilops* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of pronotum. (× 4½.)

Fig. 11.—*Neoblattella poecilops* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of supra-anal plate. (Much enlarged.)

Fig. 12.—*Neoblattella poecilops* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 11.)

Fig. 13.—*Neoblattella binodosa* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Cephalic view of head. (× 7½.)

Fig. 14.—*Neoblattella binodosa* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of pronotum. (× 4½.)

Fig. 15.—*Neoblatella binodosa* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of supra-anal plate. (Same scale as Fig. 11.)

Fig. 16.—*Neoblattella binodosa* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 11.)

Fig. 17.—*Neoblattella unifascia* new species. Male. *Type.* Nouveau Chantier, French Guiana. Dorsal view of supra-anal plate. (Same scale as Fig. 11.)

Fig. 18.—*Neoblattella unifascia* new species. Male. *Type.* Nouveau Chantier, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 11.)

PLATE XIV.—Fig. 1.—*Neoblattella longior* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of pronotum. (× 5.)

Fig. 2.—*Neoblattella longior* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged.)

Fig. 3.—*Neoblattella incompta* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of fifth abdominal tergite, showing lateral specialization. (Much enlarged.)

Fig. 4.—*Neoblattella aristonice* new species. *Male. Type.* Charvein, French Guiana. Cephalic view of head. (× 7½.)

Fig. 5.—*Neoblattella aristonice* new species. Male. *Type.* Charvein, French Guiana. Dorsal view of fifth abdominal tergite, showing lateral specialization. (Same scale as Fig. 3.)

Fig. 6.—*Neoblattella aristonice* new species. Male. *Type.* Charvein, French Guiana. Ventral view of subgenital plate (Same scale as Fig. 2)

Fig 7—*Neoblattella callosoma* new species. Male. *Type.* Nouveau Chantier, French Guiana. Dorsal view (× 4)

Fig. 8.—*Neoblattella callosoma* new species. Male. *Type.* Nouveau Chantier, French Guiana Ventral view of subgenital plate (Much enlarged)

Fig. 9—*Arawakina frontalis* new species. Male *Type.* Bartica, British Guiana. Cephalic view of head, showing interocular ridge. (Much enlarged)

Fig. 10—*Arawakina frontalis* new species. Male *Type.* Bartica, British Guiana. Ventral view of subgenital plate. (Much enlarged)

Fig 11—*Lissoblatta distincta* new species. Male. *Type* La Forestière, French Guiana. Dorsal outline of tegmen. (× 7½)

Fig. 12.—*Lissoblatta distincta* new species. Male. *Type.* La Forestière, French Guiana Ventral view of subgenital plate (Much enlarged.)

Fig. 13.—*Megraca fossata* new species. Female. *Type.* La Forestière, French Guiana. Dorsal outline of wing. (× 7½)

Fig. 14—*Anisopygia decora* new species. Female. *Type* Roches de Kourou, French Guiana. Dorsal view (× 4)

Fig. 15.—*Sciablatta galibi* new species Male. *Type.* St. Jean du Maroni, French Guiana Lateral view of subgenital plate. (Much enlarged)

Fig. 16—*Ischnoptera stygia* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view of supra-anal plate. (Much enlarged.)

Fig. 17—*Ischnoptera stygia* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 16)

PLATE XV.—Fig. 1.—*Ischnoptera rehni* new species. Male *Type.* St. Laurent du Maroni, French Guiana. Dorsal view of pronotum. (× 6½)

Fig. 2.—*Ischnoptera rehni* new species. Male. *Type* St. Laurent du Maroni, French Guiana. Ventral view of subgenital plate (Much enlarged)

Fig. 3—*Ischnoptera rehni* new species. Male. *Paratype.* Roches de Kourou, French Guiana. Caudal view of subgenital plate, showing median and dextro-proximal specialization (same scale as Fig 2)

Fig. 4.—*Ischnoptera galibi* new species. Male. *Type.* Nouveau Chantier, French Guiana. Dorsal view of pronotum (× 8½)

Fig. 5.—*Ischnoptera galibi* new species. Male. *Type.* Nouveau Chantier, French Guiana. Ventral view of subgenital plate. (Same scale as Fig. 2)

Fig. 6.—*Ischnoptera galibi* new species. Male *Type.* Nouveau Chantier, French Guiana. Caudal view of subgenital plate. (Same scale as Fig. 2)

Fig. 7—*Ischnoptera galibi* new species. Female. *Allotype.* Nouveau Chantier, French Guiana. Dorsal view of supra-anal plate. (Same scale as Fig. 2.)

Fig. 8.—*Ischnoptera paramacca* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged.)

Fig. 9.—*Ischnoptera paramacca* new species. Female. *Allotype.* St. Jean du Maroni, French Guiana. Dorsal view of supra-anal plate. (Same scale as Fig. 2.)

Fig. 10.—*Xestoblatta nyctiboroides* (Rehn). Male. Nouveau Chantier French Guiana. Caudal view of subgenital plate, showing specialised styles. (Much enlarged.)

Fig. 11.—*Galibia insignis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Dorsal view. (× 2½)

Fig. 12.—*Galibia insignis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged.)

Fig. 13.—*Galibia insignis* new species. Male. *Type.* St. Jean du Maroni, French Guiana. Caudal view of subgenital plate. (Same scale as Fig. 12.)

Fig. 14.—*Pelmatosilpha guianae* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal outline of supra-anal plate and cerci (Much enlarged.)

Fig. 15.—*Eurycotis blattoides* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal outline. (× 2½)

Fig. 16.—*Eurycotis blattoides* new species. Female. *Allotype*. St. Jean du Maroni, French Guiana. Dorsal outline of supra-anal plate and cerci (Much enlarged.)

PLATE XVI.—Fig. 1.—*Nyctibora tenebrosa* Walker. Male. Demerara, British Guiana. Dorsal view of supra-anal plate (Much enlarged.)

Fig. 2.—*Nyctibora dichropoda* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal view of supra-anal plate (Much enlarged.)

Fig. 3.—*Epilampra guianae* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 2)

Fig. 4.—*Epilampra cinnamomea* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 2)

Fig. 5.—*Epilampra taura* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 1½)

Fig. 6.—*Epilampra egregia* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 2)

Fig. 7.—*Panchlora aurora* new species. Female. *Allotype*. St. Jean du Maroni, French Guiana. Dorsal view of distal portion of tegmen, showing markings. (× 2½)

Fig. 8.—*Panchlora aurora* new species. Male. *Type*. La Forestière, French Guiana. Ventral view of subgenital plate, apex of supra-anal plate, cerci and styles (Much enlarged.)

Fig. 9.—*Panchlora regalis* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 2)

Fig. 10.—*Eulissosoma stygia* new species. Male. *Type*. Charvein, French Guiana. Caudal view of subgenital plate (Much enlarged.)

Fig. 11.—*Tairella carinatifrons* new species. Male. *Type*. Nouveau Chantier, French Guiana. Cephalic veiw of head, showing creased interocular ridge. (× 18.)

Fig. 12.—*Tairella carinatifrons* new species. Male. *Type*. Nouveau Chantier, French Guiana. Caudal view of subgenital plate (Same scale as Fig. 10.)

PLATE XVII.—Fig. 1.—*Chorisoneura stylata* new species. Male. *Type*. Bartica, British Guiana. Ventral view of styles. (Greatly enlarged.)

Fig. 2.—*Chorisoneura galibi* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Ventral view of styles (Same scale as Fig. 1.)

Fig. 3.—*Chorisoneura pusilla* new species. Male. *Type*. Nouveau Chantier, French Guiana. Ventral view of styles. (Same scale as Fig. 1.)

Fig. 4.—*Chorisoneura wayana* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 4)

Fig. 5.—*Chorisoneura elegantula* new species. Male. *Type*. St. Jean du Maroni, French Guiana. Dorsal view of pronotum and proximal portion of tegmina. (× 9)

Fig. 6.—*Chorisoneura inversa* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorsal view of pronotum (× 9)

Fig. 7.—*Chorisoneura strigifrons* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorsal view (× 4)

Fig. 8.—*Chorisoneura strigifrons* new species. Female. *Type*. St. Jean du Maroni, French Guiana. Dorso-cephalic view of occiput and interocular space. (Much enlarged.)

Fig. 9.—*Chorisoneura splendida* new species. Male. *Paratype*. Kartabo, British Guiana. Dorsal view. (× 4.)

Fig. 10.—*Chorisoneura splendida* new species. Male. *Type*. Kartabo, British Guiana. Ventral view of styles. (Same scale as Fig. 1.)

Fig. 11 —*Proscratea complanata* (Perty) Female St Jean du Maroni, French Guiana. Dorsal view. (× 3)

Fig 12 —*Galiblatta cribrosa* new species Male *Type* St. Jean du Maroni, French Guiana. Dorsal view (× 2)

Fig 13 —*Galiblatta cribrosa* new species Female *Allotype*. St Jean du Maroni, French Guiana. Dorsal view. (× 2)

A NEW GENUS AND SPECIES OF PHOSPHORESCENT FISH, KRYPTOPHANARON ALFREDI

BY CHARLES F SILVESTER AND HENRY W. FOWLER

While collecting off the coast of Jamaica in July 1908, Professor Ulric Dahlgren of Princeton University found floating on the surface of the sea, a single individual belonging to the rare and remarkable family of fishes, the Anomalopidae

This discovery is one of unusual interest connecting, as it does, West Indian waters with a small restricted family of fishes thought to be confined to the Indo-Moluccan archipelago and the South Pacific We therefore describe it as a new genus and species

Possessing the peculiar phosphorescent organs characteristic of the family, this little fish is capable of turning on, or off, its stream of light at will

Through the courtesy of Professor Max Weber, the writers have been enabled to compare this specimen with *Photoblepharon* Weber, and *Anomalops* Kner, the two known genera from the Indo-Pacific.

It is with pleasure that we express thanks to Professor Weber, and to Professor Dahlgren, for their courtesy and valuable assistance

SYNOPSIS OF THE GENERA

A Spinous dorsal present

- a. Anal spines III Dorsals without interspace. Phosphorescent organ with membranous curtain Lateral line distinctly arched in front and with series of well-developed pores Scales very small. Mandible slightly projecting Premaxillae deeply notched Single fleshy tubercle behind eye Body robust, compressed, deep, symmetrical Ventrals do not reach vent. *Kryptophanaron*
- b Anal spines II. Spinous dorsal with interspace. Phosphorescent organ without membranous curtain Lateral line not arched, irregularly straight, no prominent pores. Scales medium and regular. Snout blunt Body robust, elongated. Series of tubercles bordering eye posteriorly Ventrals reach vent. *Anomalops*

B. No spinous dorsal.

- a Anal spines II. Phosphorescent organ with membranous curtain. Lateral line distinctly arched in front, with pores. Scales very small. Single fleshy tubercle behind eye. Body compressed Caudal peduncle very long *Photoblepharon.*

KRYPTOPHANARON new genus[1]

Spinous dorsal present, anal spines III Phosphorescent organ with membranous curtain capable of covering same Lateral line distinctly arched with series of well-developed pores Scales very small, each one with several fine tubercles Series of scales along lateral line and at bases of soft dorsal and anal Teeth in villiform bands on jaws and vomer Pseudobranch large Tongue well developed Maxilla abruptly expanded behind Premaxilla notched, protractile Mandible projecting Body compressed, deep Ventral carina present Eye large Mouth inclined Nostrils double. Fleshy tubercle behind eye No processes around eyelid Gills four, slit behind fourth. Gill-rakers slender Stomach caecal, pyloric caeca present. Swim-bladder divided, thin walled.

Type *Kryptophanaron alfredi* new species

Kryptophanaron alfredi new species. Plate XVIII, fig 1, Plate XIX, figs. 2 and 4

D. IV, II, 14; A. III, 10, V I, 6; P 16 left side, 17 right side, C 8, 20, 8, scales about 20–150–60 Branchiostegals VII.

Head ⅔ to end of lateral line, 3 in total length, ⅞ as deep as long; height of body at dorsal interspace 2½ in length; breadth of head ½ of its length Eye very large, oblong, reaching to upper surface of head, its long diameter 2¾ in head One large tubular lobule borders the eye posteriorly Vertebrae 16 + 14. Luminous organ situated directly under the eye and of about the same length, about ⅓ as deep as long, partially free and movable with highly pigmented membranous curtain capable of covering same. Nostril double, separated from eye by thin membrane of anterior orbital ring; the posterior one large and bounded above by tuberculous bony ridge, anterior small, in short tube. Bones of head entire, scaleless and finely sculptered, divided by naked tubiferous interspaces. Premaxillary bones protractile, long and slender, forming a notch in the median line. Maxilla slender anteriorly, becoming abruptly expanded at its posterior third and reaching to behind the vertical from the center of the pupil. Snout very short, concave, lower jaw projecting. Interorbital space broad, slightly convex, ¾ diameter of eye Bands of villiform teeth on jaws and palatine bones; vomer and tongue toothless. Clavicle broad, posterior edge above pectoral fin, expanded and projecting free Post-temporal strong. Post-clavicle slender Pseudobranch large and well developed. Gills four, slit behind the fourth; membranes free from isthmus. Gill rakers long, seven above and nineteen below the angle. Dorsal fins not separated by interspace; spines weak; soft dorsal with three small spines Ventrals well developed, half the length of head and reaching ¼ fin-length from vent. Pectorals rounded and longer than ventrals. Caudal broad and forked, about 5½ in total length, with seven spines above and seven spines below the soft rays. Least height of caudal pedicle 3¾ in head. Scales very small and rather irregular in arrangement, about 20–150–60, each one with several spines which become longer and more prominent toward the posterior half of the body Abdomen serrated with seven white and possibly luminous scutes. Lateral line well marked, commencing near the posterior angle of the post-temporal and runs entire length parallel to the dorsal profile to base of middle ray of caudal; with about thirty-four enlarged scutes covering series of pores. Row of sixteen white, possibly luminous, scutes at base of soft dorsal. Swim-bladder large, thin-walled and divided by partition. Peritoneum not pigmented, stomach caecal, pyloric caeca large, ten in number, intestine coiled into two loops, gall-bladder medium large, anal papilla prominent Body shortened and compressed, region above and below axis equally developed Color dark chocolate brown Phosphorescent organ light yellow, curtain black, iris dark. Length 104 mm.

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[1] Κρυπτός, hidden; φανάριον, lantern.

Known only from the type A sexually mature female found floating on the surface of the sea off Kingston Harbor, Jamaica, W. I.

Named for Mr Alfred Mitchell

EXPLANATION OF PLATES XVIII AND XIX

PLATE XVIII

Fig. 1 —*Kryptophanaron alfredi* new genus and species.
Fig 2 —*Anomalops katopiron* (Bleeker)
Fig 3 —*Photoblepharon palpebratus* (Boddaert)

PLATE XIX.

Fig. 1 —*Anomalops katopiron* (Bleeker) Radiograph
Fig 2 —*Kryptophanaron alfredi* new genus and species. Radiograph.
Fig. 3 —*Photoblepharon palpebratus* (Boddaert) Radiograph
Fig 4.—Enlarged head of *Kryptophanaron alfredi*

FISHES FROM FLORIDA, BRAZIL, BOLIVIA, ARGENTINA, AND CHILE

BY HENRY W FOWLER

The notes given below pertain largely to several small collections recently received by the Academy Though few of the species are new a number are rare or unusual in collections In these cases condensed items of variation are given, the same method employed as outlined in the introduction to my paper on South African fishes of last year [1]

FLORIDA

Mr Morgan Hebard secured a small collection of interesting young fishes at Boca Grande Key in early June of 1923 A few Poecilids were received from Mr Charles J Pennock, obtained at Punta Gorda in May 1925 Some large aquarium fishes collected at Sand Key, by Dr Robert O Van Deusen, were brought from the Fairmount Aquarium by Dr Henry Winsor In the spring of 1926 Mr R Dale Benson, Jr made some notes on the larger fishes while at Captiva Pass, which are also included

Ginglymostoma cirratum (Bonnaterre)

One at Captiva of 55 lbs

Sphyrna zygaena (Linné)

A female 396 5 cm, between 800 and 900 lbs in weight, contained 36 young, each of which 356 mm long In the stomach of the adult were 3 rays (evidently *Dasyatis sabina*) with a disk length of 458 to 610 mm and in the mouth 1 ray of 509 mm There were also remnants of 17 caudal spines in the stomach, the largest complete 75 mm and largest estimated at 100 mm The jaws were also punctured with other spines and at least 24 spines in the gums.

Amiatus calvus (Linné)

Mr Benson found it common in Lake Trafford, April 7th, and the three centrarchids listed below.

Megalops atlanticus Valenciennes.

Abundant at Captiva

Albula vulpes Linné.

Few at Captiva

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[1] Proc Acad Nat. Sci Phila, LXXVII, 1925, pp 187–268.

Jenkinsia stolifera (Jordan and Gilbert)

Boca Grande, 19 examples 15 to 20 mm   Uniformly pale brownish, with silvery on head   Fins whitish

Harengula pensacolae Goode and Bean

Boca Grande, 21 examples, 30 to 37 mm   Bright silvery white

Harengula sardina (Poey)

Boca Grande, 3 examples, 25 to 28 mm   Scales all fallen   Head and fins whitish, former with silvery

Bagre marinus (Mitchill)

Mr Benson reports it from the Caloosahatchie tidal near Fort Myers

Lycodontis moringua (Cuvier)

Three from Sand Key, 775 to 965 mm

Lycodontis funebris (Ranzani)

One from Sand Key, 726 mm   Anal narrowly edged with white.

Fundulus similis (Baird and Girard)

Eight from the stomach of a Louisiana Heron, 28 to 62 mm killed at Punta Gorda on March 31, 1925   One 56 mm taken from a stomach of a Least Bittern, killed at Charlotte Harbor, March 18, 1925, by Mr Pennock

Gambusia affinis (Baird and Girard)

Five from Punta Gorda, 24 to 34 mm , of which one from the Louisiana Heron

Heterandria formosa Agassiz

One from Punta Gorda, 25 mm

Mollienisia latipinna Le Sueur

Two from the Louisiana Heron at Punta Gorda, 33 to 50 mm. and two from the Least Bittern at Charlotte Harbor 55 to 60 mm.

Syngnathus mackayi Swain and Meek.

Boca Grande, 37 examples 50 to 94 mm   Snout 1¾ in head Dorsal on 2 body rings and 5 caudal rings   Caudal rings 34.

Hippocampus stylifer Jordan and Gilbert.

One from Boca Grande, 25 mm. Snout longer than postocular. D 16, on 2 body and 1 caudal rings. Body largely brown.

Strongylura timucu (Walbaum)

Two from Boca Grande, 40 to 65 mm.

Body very slender Jaws slender, lower at least ½ to ⅔ longer than upper. Lateral line without lateral keel on caudal peduncle. D 15 A 17 Caudal lunate. Body and head above with pale yellowish brown, dotted with darker brown Fins all pale or whitish

Strongylura marina (Walbaum)

Common at Captiva Pass

Strongylura raphidoma (Ranzani)

Four from Boca Grande, 24 to 50 mm Jaws short and strong, upper to eye equals rest of head Interorbital 1⅘ in postocular Dorsal with last rays high as first and together with median rays blackish Other fins whitish

Hyporhamphus unifasciatus (Ranzani)

Few at Captiva Pass

Exocoetus volitans Linné

Several at Captiva Pass

Holocentrus ascensionis (Osbeck)

One example at Captiva Pass

Mugil cephalus Linné.

Captiva Pass

Mugil curema Vlaenciennes.

Six from Boca Grande, 17 to 33 mm

Sphyraena barracuda (Walbaum)

Eight from Boca Grande, 37 to 48 mm The scales, though very small, are distinct along the lateral line and number upward of 80

Sarda sarda (Bloch).

One at Captiva Pass, 762 mm between 9 and 10 lbs

Seriola lalandi Valenciennes

Captiva Pass

Caranx hippos (Linné)

Captiva Pass

Chloroscombrus chrysurus (Linné)

Six from Boca Grande, 10 to 14 mm Maxillary rather large. Preopercle with spine at angle and several smaller ones along edge. Lateral line unarmed. Caudal lunate. Ventrals distinct.

Trachinotus carolinus (Linné)

Eleven from Boca Grande, 10 to 20 mm. and 3 examples 28 to 65 mm The largest of the smaller lot with depth 2 and color quite dusky Mr Benson reports adults at Captiva Pass

Pomatomus saltatrix (Linné)

Captiva Pass

Rachycentron canadum (Linné)

One of 46 lbs at Captiva Pass

Pomoxis sparoides (Lacépède)

Common in Lake Trafford with the next two species.

Lepomis incisor Valenciennes

Micropterus salmoides (Lacépède)

Serranus striatus (Bloch)

Few of 15 lbs at Captiva Pass

Promicrops guttatus (Linné).

One of 15 lbs at Captiva Pass and 1 of 273 lbs at Fort Myers

Diplectrum formosum (Linné)

Captiva Pass, with the next four species

Lutjanus jocu (Schneider)

Lutjanus aya (Bloch)

Common to 4 lbs

Lutjanus analis (Cuvier)

Ocyurus chrysurus (Bloch)

Few taken

Haemulon plumieri (Lacépède)

One from Sand Key, 248 mm

Anisotremus virginicus (Linné)

Three from Sand Key, 200 to 223 mm

Stenotomus chrysops (Linné)

Small example at Captiva Pass

Lagodon rhomboides (Linné).

Three from Sand Key, 206 to 230 mm

Archosargus probatocephalus (Walbaum)

Common at Captiva Pass, also the next

Sciaenops ocellatus (Linné)

Leiostomus xanthurus Lacépède.

One from Sand Key, 337 mm

Menticirrhus americanus (Linné)

Abundant at Captiva Pass Appeared April 11, not biting well

Menticirrhus littoralis (Holbrook)

Twelve from Boca Grande, 22 to 68 mm. Gill-rakers 5 + 8. Largely white, back with slight tint of light drab Fins all whitish

Chaetodon capistratus (Linné)

One from Sand Key, 137 mm

Pomacanthus arcuatus (Linné)

One from Sand Key, 194 mm

Pomacanthus paru (Bloch)

One from Sand Key, 210 mm This is very similar to the figure of *Pomacanthus rathbuni* Miranda Ribiero[1] from Brasil. His figure, on the same plate, of *Pomacanthus arcuatus* is also like my specimen of that species

Angelichthys ciliaris (Linné)

One from Sand Key, 273 mm

Angelichthys isabelita Jordan and Rutter

One from Sand Key, 240 mm It differs from the preceding in the absence of a blue predorsal ocellus and the pale pectoral base and pale vertical fins

Bodianus rufus (Linné)

One from Sand Key, 286 mm.

Callyodon coeruleus (Bloch)

Six from Sand Key, 203 to 382 mm

Leptecheneis naucrates (Linné)

One from Sand Key, 465 mm

Gobiesox strumosus Cope.

One from Boca Grande, 12 mm.

Body brown. Dorsal and anal pale. Caudal brown, with broad white transverse basal band, narrowing medially.

Stephanolepis hispidus (Linné).

Boca Grande, 29 examples, 13 to 30 mm.

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[1] Arch Mus. Nac. Rio Janeiro, 17, 1915, Chaetodontidae, p. 7, Pl, lower figure.

Depth of smallest at anal origin 2, of largest 1⅜ Mr. Hebard describes it as silvery mottled with greenish gray. Dots of silver on sides. Eyes golden, no black center.

Alutera scripta (Osbeck)

Boca Grande, 9 examples, 23 to 90 mm All with caudal elongated, even very young

Sphoeroides testudineus (Linné)

Boca Grande, 12 examples, 6 to 17 mm.

Interorbital 1⅜ in snout or 1¾ in large eye Body and head entirely covered with short bristles Back with a few scattered brown spots. No dark spots along sides Fins pale, uniform. According to Mr. Hebard shining, dull green and blackish, mottled above, silvery below.

Chilomycterus schoepfi (Walbaum)

One from Boca Grande 16 mm which agrees in every way with the nominal *Lyosphaera gibbosa* Evermann and Kendall Mr. Hebard notes it as dull yellowish olive and black, beneath with spines clear light yellow Eyes golden and black.

Mr Benson found a few adults at Captiva Pass

Oncocephalus radiatus (Mitchill)

One at Captiva Pass

BRAZIL

A small collection was received from Messrs Rudolf M de Schauensee and James Bond, made in the vicinity of Pará during the late winter and early spring of 1926

Astyanax fasciatus (Cuvier)

Sixty-eight examples, 35 to 73 mm All have the predorsal completely scaled

Creatochanes caudomaculatus (Günther)

One example, 36 mm , from Rio Inhangpy on March 6. Maxillary not quite reaching suture of second and third interorbitals.

Hemigrammus unilineatus Gill.

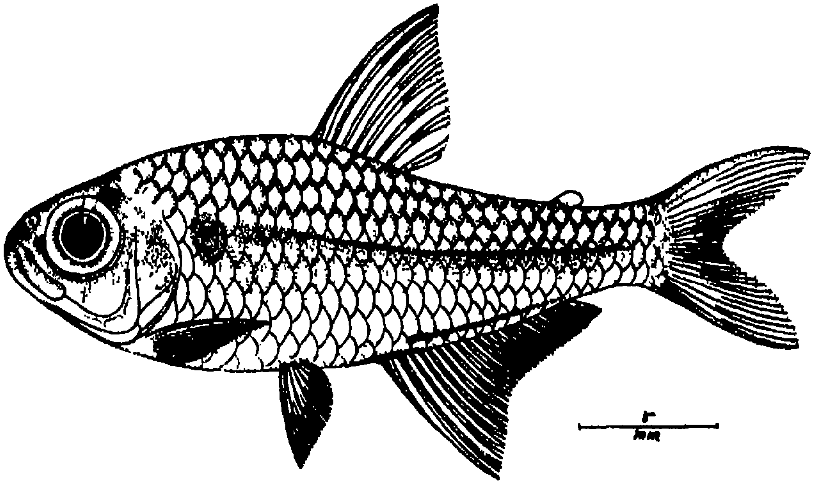
One example, 30 mm.

Hyphessobrycon schauenseei new species.

Depth 3; head 3¼, width 2⅜. Snout 3 in head from snout tip; eye 2¼, greater than snout or interorbital, maxillary extends down obliquely opposite middle of eye, length 2 in head; jaws even; teeth moderate, mandibular little larger; interorbital 3, broadly convex;

suborbitals broad, largely cover cheek Gill-rakers 1 + 12, lanceolate, moderate.

Scales 28 in median lateral series to caudal base and 3 more on latter, 9 transversely at anal origin, 11 predorsal Fins all naked except scaly base of caudal. Scales with 2 or 3 radiating striae; circuli imperfect Lateral line not evident. D. II, 8, first branched ray long as head, adipose dorsal ¾ of eye, A III, 22, first branched ray 1⅓ in head, least depth of caudal peduncle 4; caudal forked, slender pointed lobes equal head, pectoral 1⅓, ventral 1⅔.



Hyphessobrycon schauenseei new species

Pale grayish brown generally. Each scale on back and edge dusted with dusky, forming a reticulated appearance Dark median streak down back and another following along side opposite vertebral axis, darker along tail and caudal peduncle. Diffuse humeral dusky blotch nearly large as pupil Costal region and cheeks sprinkled with dusky dots Dark line along lower part of tail just above anal base and another at and along front of anal base. Fins all uniform grayish.

Type 31 mm Rio Inhangpy, Pará, Brazil Also three paratypes, 25 or 26 mm , same data All obtained March 6.

This species is greatly suggestive of *Hemigrammus orthus* Durbin from British Guiana, though with far deeper body and without a dark spot at the caudal base

Named for Mr Rudolf M de Schauensee, who collected the type.

Moenkhausia bondi (Fowler).

Two small examples, 26 to 30 mm from the Rio Inhangpy, obtained March 6, 1926, seem to agree with this species Their highly contrasted color pattern is apparently the result of formaline, especially the dark areas. I have compared the types of *Phenacogaster bondi* Fowler and though much larger their light coloration is largely retained through preservation in rum Compared with the same the young Pará examples have the depth 2⅗, snout 3 in head from snout tip, eye 2¼; maxillary reaches beyond front eye edge or about opposite front pupil edge, length 2 in head, interorbital 3, gill-rakers 10 + 12, 2 radiating apical striae and 6 or 7 basal circuli on scales, first branched anal ray nearly long as head, blackish humeral blotch, less than eye in width though greater than eye-diameter in depth, placed 2 scales behind gill-opening, area in front and behind humeral blotch light or pale, narrow dusky line marks vertebral line, beginning 2 scales behind humeral blotch; fins grayish, front edges of dorsal, anal and ventrals all deep dusky. As the species is known only from Venezuela and Guiana its occurrence at Pará is interesting

Erythrinus erythrinus (Linné)

Nine from Pará, 93 to 150 mm.

Rhamdia sebae (Valenciennes)

Twelve from Pará, 92 to 154 mm

Hoplosternum thoracatum (Valenciennes).

Two from Pará, 68 to 143 mm The smaller example with large and contrasted dark spots on lower surface of head and abdomen. Dark spots on body also larger and along lower side 10 slightly oblique dark streaks

Synbranchus marmoratus Bloch

One from Pará, 207 mm

Lebistes reticulatus (Peters)

From Pará, 32 males and 53 females, February 20 Former 20 to 28 mm and in only 2 examples the dark blotch present on lower side of tail just behind and above anal fin. The females all show at least traces of the dark costal blotch

Poecilia branneri Eigenmann.

With the preceding, 21 males, 16 to 30 mm

Last dorsal rays from sharp point reaching back nearly to middle of caudal. Large black blotch at caudal base larger than eye in adults, smaller in young, always very distinct and contrasted. Tail with yellowish tinge Five vertical lines of dusky-gray on side Dark band extends from middle of caudal base, outer edge largely blackish to middle of upper caudal edge, often giving forked appearance above

Nineteen females, 16 to 39 mm Dorsal rounded and caudal immaculate Black basal caudal spot always present, though less than eye

Strongylura microps (Günther)

Depth 8 in head, body rather broadly depressed, head 3 in total, width 2¾ in postocular, snout 1⅗ in head, jaws not completely closing basally, eye 3¾ in postocular, maxillary exposed, reaches opposite front pupil edge, inner row of teeth larger, conic, well spaced, vertically erect, interorbital 4⅗ in postocular, level, with wide median depression No rakers Scales about 315 + 6 in lateral series, 19 above lateral line, 9 below, predorsal about 210 to occiput, 28 behind eye to preopercle ridge, rather broad keel along side of tail and caudal peduncle D iii, 10, first branched ray 1⅗ in postocular, last ray ¼ lobe of fin, A ii, 14, first branched ray 1⅓ in postocular, caudal 1⅞, equally emarginate, caudal peduncle depth half its width or 2¾ in eye, P i, 9, 1⅓ in postocular, ventral 2⅕ Light brown generally or only very slightly dilute olivaceous on back with each scale narrowly edged darker Upper edge of beak dusky Iris whitish Dark leaden band along caudal keel to blackish at middle of caudal Under surfaces all whitish Length 222 mm (beak tip damaged)

One from Pará, agreeing in most every way with Günther's description of *Belone microps* from the Guianas

Æquidens tetramerus (Heckel)

Depth 2 to 2¼, head 2⅗ to 2½, width 1⅗ to 2, snout 3¾ to 3⅞, eye 2⅗ to 3, greater than snout or interorbital or equals interorbital with age, maxillary reaches eye, 3¼ to 3½ in head; interorbital 3⅓ to 3⅗, nearly level or only very slightly convex Rakers 3 + 5, short. Scales 16 or 17 + 8 + 1 or 2, 3 above, 9 below, 7 or 8 predorsal extending forward opposite front pupil edge, 3 or 4 rows on cheek to preopercle ridge, 11 or 12 basal radiating striae, 38 to 44 apical points with 6 to 8 series transversely less developed D XV, 11, fourth spine 3 in head, fifth ray 1⅓ to 1½, A III, 8 or 9, third spine 2⅗ to 3, fifth ray 1½ to 1⅞, caudal rounded, 1$\frac{1}{10}$ to 1¼; least depth caudal peduncle 2½ to 2⅗, pectoral 1⅓ to 1½, ventral 1⅓ to 1⅝ Dull brown, paler on head below and belly About 8 vertical dark transverse bands, third with blackish blotch just below lateral line and nearly large as eye; last with small black blotch at caudal base above. Diffuse dark streak or blotch on cheek below eye Iris brownish. Fins grayish, soft dorsal with several darker bands inclined forward and traces of several darker transverse bands on caudal Outer ventral edge dusky Length 35 to 54 mm.

Four from Pará.

BOLIVIA

During 1921 a collection comprising small fishes was purchased by the Academy from José Steinbach It was obtained from Buenavista, or environs, in the Department of Santa Cruz, in eastern Bolivia The drainage area is in the headwaters of the Rio Madeira and eventually the upper Amazons

Nannostomus stigmasemion Fowler

Fourteen from Buenavista 28 to 34 mm

Four from curichecito, campos de Dolores, Buenavista, 500 m March 7

From corriente pequeña, campos de Delores, Buenavista, 115 examples, 24 to 41 mm Elevation 500 m

Characidium fasciatum Reinhardt

Four from Buenavista 28 to 31 mm

One from curichecito, campos de Dolores, Buenavista, 500 m March 7 Length 30 mm

Nine from corriente pequiña, March 12 to 20, 24 to 30 mm long

Astyanax bimaculatus (Linné)

One from quebrada en la campos, region Dolores, January 1921. Length 68 mm

Two from corrientes pequeña, campos de Dolores, 500 m March 10 to 14 Length 48 to 72 mm

Hemigrammus schmardae (Steindachner)

Twenty-four from quebrada en la campos, region Dolores, 500 m January to March 6 Length 24 to 39 mm

Forty-four from curichecito, campos de Dolores, 500 m March 7 Length 14 to 28 mm

From conentes pequeña, campos de Dolores, 500 m March 10 to 20. Length 14 to 39 mm., 165 examples

Hyphessobrycon callistus (Boulenger).

Two from Buenavista, 19 to 26 mm.

Four from curichecito, campos de Dolores, 500 m. March 7. Length 20 to 25 mm

One from corriente pequeña, campos de Dolores March 12. Length 23 mm

Though known only from the Paraguay basin in Brasil and Paraguay the examples before me are in agreement with Eigenmann's description and figure[2] The species is therefore also an inhabitant of the upper basin of the Madeira

Moenkhausia lepidura (Kner)

Two from quebrada, campos de Dolores, 500 m January Length 35 to 38 mm

Seven, same data March 6

Length 33 to 36 mm These without any dark humeral blotch Base of each caudal lobe yellowish, border and median rays of fin dusky Narrow leaden vertebral line on side of body broadens little at caudal peduncle

Seven from corriente pequeña, campos de Dolores March 10 to 20 Length 27 to 38 mm

Erythrinus erythrinus (Schneider)

One from Buenavista, 109 mm

Gymnotus carapo Linné

One from Buenavista, 175 mm

Pygidium rivulatum (Valenciennes)

Example 168 mm long in poor preservation, also headless bodies of 7 others about same size All without definite locality Possibly they may have been brought from Lake Titicaca?

Æquidens portalegrensis (Hensel)

Depth 2⅓, head 2⅗ to 2¾, width 1⅘ to 2, snout 3½ to 3⅗ from snout tip; eye 3 to 3⅖, greater than snout, 1 to 1¼ in interorbital; maxillary reaches to or slightly beyond front eye edge, 3 to 3⅓ in head, interorbital 2⅘ to 2⅗, broadly convex Rakers 2 + 6, short. Scales 15 or 16 + 7 + 1, 3 above, 8 or 9 below, 9 or 10 predorsal forward opposite front eye edge, 3 rows on cheek to preopercle ridge, 11 or 12 basal radiating striae, 46 to 69 apical points with 4 to 8 transversely less developed D. XV, 9 or 10, fourth spine 2⅘ to 3⅒ in total head, length fourth, ray 1⅓ to 1½, A III, 8, third spine 2⅓ to 2½, fifth ray 1¼ to 1⅓; caudal rounded, 2⅘ to 3 in combined head and body to caudal base, caudal peduncle depth 2⅓ to 2½, pectoral 1 to 1⅓; ventral 1 to 1⅓. Rather dark brown generally, with about 8 obscure transverse dark bands, broader than interspaces. Black band from behind eye, below lateral line to third dark transverse band where forming spot but little less than eye. This band indistinctly reflected over upper part of tail toward black blotch at bases of upper caudal rays. White band narrowly around tip of snout, includes nostril and reaches front eye-edge. Below eye posteriorly blackish blotch on cheek above Fins all more or less dusky, caudal more grayish and with about four oblique deeper dusky lines basally

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[2] Mem. Mus. Comp. Zool., 43, pt. 2, 1918, p 178, Pl. 24, fig 3

One from quebrada, campos de Dolores, 500 m Length 74 mm

One from corriente pequeña, campos de Dolores, 500 m Length 53 mm

The species previously known from the Rio Paraguay and Rio Grande do Sul

Æquidens paraguayensis Eigenmann and Kennedy

Depth $2\frac{3}{5}$ to $2\frac{3}{4}$, head $2\frac{3}{5}$ to $2\frac{3}{4}$, width $1\frac{3}{5}$ to 2, snout 3 to $3\frac{1}{4}$; eye $2\frac{3}{4}$ to $3\frac{1}{4}$, greater than snout or interorbital, though equals latter with age; maxillary to front eye edge, 3 in head, interorbital 3 to $3\frac{1}{4}$, only very slightly convex or largely level medially Rakers 1 + 6, broad, short Scales 14 or 15 + 8 or 9 + 2, 3 above, 8 below, 8 predorsal forward opposite front eye edge, 3 rows on cheek to preopercle ridge, 12 or 13 basal radiating striae, 65 to 103 apical points with 8 or 9 transverse series of basal elements D XIV, 8 to 10, fourth spine $2\frac{1}{3}$ to 3 in head, fourth ray $1\frac{1}{5}$ to $1\frac{3}{5}$, A. III, 7, third spine $2\frac{1}{4}$ to $2\frac{3}{5}$, fourth ray $1\frac{1}{5}$ to $1\frac{1}{3}$, caudal truncate behind, 1 to $1\frac{1}{10}$, least depth of caudal peduncle $2\frac{1}{5}$ to $2\frac{1}{4}$, pectoral 1, ventral $1\frac{1}{5}$ to $1\frac{1}{5}$. Brown generally, slightly paler below Eight darker transverse bands, with second to fourth broken at lateral line. Blackish brown band from upper hind eye-edge to fourth dark transverse band, ending as blotch little larger than pupil below lateral line Small blackish spot, little less than pupil, at bases of upper caudal rays. Brownish bar from lower hind eye-edge across postocular and opercle Dark vertical bar below eye on cheek. Dorsals and caudal grayish Pectoral pale Ventral and anal dusky-gray Length 50 to 80 mm.

Five from corriente pequeña, campos de Dolores, 500 m March 10 The upper dark postocular band variably forms series of 3 blotches with only very narrow isthmus of connecting color in some cases

Crenicichla lepidota Heckel.

Depth 4, head $2\frac{2}{5}$, width $2\frac{1}{5}$; snout 4 from snout tip; eye 4, equals snout or interorbital; maxillary reaches opposite front pupil-edge, $2\frac{3}{5}$ in head; interorbital 4, level; hind preopercle edge minutely serrate Rakers 3 + 9, robust, lanceolate. Scales 22 + 11 + 2 in lateral line, 4 above, 9 below, 16 predorsal forward midway in interorbital, 6 rows on cheek to preopercle ridge; 11 basal radiating striae, 23 to 24 apical denticles with 6 or 7 in transverse series. D. XVII, 14, tenth spine $2\frac{3}{5}$ in total head length, eleventh ray $1\frac{2}{3}$; A. III, 9, third spine $3\frac{1}{5}$, seventh ray $2\frac{1}{10}$; caudal convex behind, $1\frac{2}{5}$;

caudal peduncle depth 3⅓, pectoral 1⅗, ventral 1⅗. Brown above, paler below. About dozen diffuse darker transverse bands over back. Dark brown band includes lips to eye, then across postocular to just over pectoral base and obscurely along median axis of body. Black ocellus with whitish margin, little smaller than eye at caudal base little superior Dorsals and caudal grayish, soft dorsal with several whitish or pale bands obliquely forward and bordered diffusely with darker Several similar transverse bands irregularly on caudal. Anal whitish basally, deep grayish terminally Paired fins pale Length 65 mm

One from corriente pequeña, campos de Dolores March 14

ARGENTINA

A collection of dried skins of some of the larger food fishes from Buenos Aires, was received through the Argentine Government in 1917 Also a small collection of alcoholic fishes, purchased from Pedro Serié The marine forms were obtained on the Atlantic coast of the Mar del Plata off Buenos Aires in February to March 1922 The fresh-water forms are from the Rio de la Plata

Mustelus mustelus (Linné)

Dry skin 629 mm

Curimatus platanus Günther

Depth 2⅗ to 3, head 3⅕ to 3⅖, width 2 to 2⅓, snout 3⅓ to 3½, eye 4 to 4⅓, 1⅓ to 1⅖ in snout, 1⅓ to 1¾ in interorbital, adipose lids rather wide, maxillary 4⅓ to 4⅔ in head; interorbital 2⅖ to 2⅔, broadly convex, nostrils together, hind one midway in snout, suborbitals broad, completely cover cheek No rakers Scales 46 to 51 + 5 to 7 in straight lateral line, 12 above, 8 or 9 below, 21 to 23 predorsal, 0 to 2 apical radiating striae, circuli moderate. D. ii, 8, i or 9, i, first branched ray 1¼ to 1⅓ in head, adipose fin 3 to 3⅕; A iii, 7, i, first branched ray 1⅞ to 2, caudal peduncle depth 2¼ to 2⅗, pectoral 1⅗ to 1⅘; ventral 1⅗ to 1⅔, caudal well forked, 3 to 3⅕ in combined head and body Body largely overlaid with silvery reflections. Back brown, lower surfaces white. Large diffuse dusky blotch at base of caudal medianly Dorsals and caudal brownish, other fins pale Iris pale. Length 118 to 157 mm

Three from Rio de la Plata. They agree with Günther's description, based on 2 examples 153 mm.[3]

Prochilodus platensis Holmberg

Depth 3, head 3⅞, width 1⅗, snout 2¾, eye 6⅓, 2¾ in snout, 3⅓ in interorbital; mouth width 2⅗ in head; interorbital 2; frontal fontanel to occiput, postorbital wide as eye, infraorbitals narrow so that forward half of cheek naked to preopercle ridge, suborbitals and opercles finely striate Scales 43 + 5, 9 above, 7 below, 21 predorsal, tubes in lateral line slender, simple, well exposed, median basal stria and 1 to 5 transverse radiating apically, 28 to 50 imperfect apical denticles and circuli fine D. II, 9, first branched ray 1⅗ in head, A III, 8, I, first branched ray 2, small adipose fin 4⅗, caudal peduncle depth 2⅘, caudal 1⅒, emarginate, lobes rather rounded, pectoral 1½, ventral 1⅗ Back brown, below paler Edge of each scale on back narrowly darker Fins dull brown Length 500 mm

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[3] Ann Mag Nat. Hist., London, (5) 6, 1880, p 12. Rio de la Plata.

Buenos Aires

Salminus maxillosus Valenciennes

Depth 3⅞, head 3⅔, width 2, snout 3⅗, eye 9, 2⅔ in snout, 2⅗ in interorbital, maxillary 1⅔ in head, teeth in jaws uniserial, conic, above 38–14–37, below about 50 ?, interorbital 3⅓ in head, broadly convex, all bones of head more or less striate, especially enormously enlarged suborbitals, parietals and frontals with some rugose striae Scales 92 + 5, 17 above, 11 below, 64 predorsal, tubes in lateral line broadly exposed and each with 3 or 4 pores, 10 to 26 apical striae, imperfectly radiating and circuli fine. D II, 9, first branched ray $1\frac{3}{10}$ in head, A III, 21, first branched ray 2⅗; adipose fin 6½, caudal peduncle depth 3, caudal 1½, very slightly emarginate behind, pectoral 1⅗, ventral 2⅔ Back brownish, lower surfaces paler Above lateral line each row of scales with dark line medially, producing longitudinal parallel lines Fins all pale brownish, little dusky at bases of caudal and anal Length 683 mm

Buenos Aires

Leporinus obtusidens (Valenciennes)

Depth 3¼ to 3⅓; head 3⅔ to 3¾, width 1¾ to 2⅕, snout 2⅓ to 2⅞, eye 4⅗ to 6½, 2 to 2¾ in snout, 2 to 3 in interorbital, maxillary 3⅗ to 4⅓ in head, 6 compressed incisors in front of each jaw; front nostril short tube midway on side of snout, hind one larger pore little nearer front nostril than eye, interorbital convexly elevated, 2 to 2⅖ in head, postorbital nearly wide as eye, infraorbitals narrow, cheek greatly exposed, opercles and suborbitals smooth Scales 37 + 3, 6 or 7 above, 5 below, 14 or 15 predorsal; 0 to 1 basal radiating stria, 3 to 8 apical and circuli very fine. D II, 9, I or II, 10, I, first branched ray 1⅓ to 1⅗, adipose fin 4 to 4¼, A. III, 8, I, first branched ray 1⅗ to 1⅞; caudal peduncle depth 2⅕; pectoral 1⅗ to 1⅞; ventral 1⅓ to 1½; caudal 2⅘ to 3⅓ in combined head and body, well forked Back brown, with about 8 to 10 broad diffuse transverse blotch-like bands on back, sometimes more or less variable. Under surface paler Dorsal and caudal with brownish, other fins whitish. Length 240 to 340 mm.

Two from the Rio de la Plata.

Astyanax fasciatus (Cuvier)

One example 102 mm Rio de la Plata

Luciopimelodus pati (Valenciennes)

Depth 6 to 6⅓, head 3⅓ to 3⅜, width 1⅛, snout 2⅒ to 2⅓, eye 11 to 11⅗, 5¼ to 6 in snout, 2⅓ to 2⅕ in interorbital, mouth width 2¼ to 2⅜ in head, villiform teeth in broad bands in jaws, upper with inner triangular extension behind and in 7 or 8 irregular series in both jaws; palate edentulous, maxillary barbels to anal origin or midway in adipose fin, sometimes nearly to end of latter, outer mental barbel to middle of depressed ventral, inner mental barbel midway or ¾ in depressed pectoral, front nostril close to front snout edge, hind one at first ⅗ in snout, interorbital 5 to 5⅓ in head, broadly depressed, frontal fontanel extends but little beyond eyes and small round fontanel at base of occipital process, interoccipital space to dorsal buckler 5⅓ to 6⅜ in head, top of head with fine osscus striae longitudinally, also opercle with fine radiating striae; skin of head with rather large reticulating venules Rakers 4 + 13, lanceolate, rather short D. I, 6, i, slender smooth spine flexible terminally, 1⅓ to 1⅜ in head, first ray 1⅖ to 1½, A iv or v, 8, i, first branched ray 2 to 2⅕, caudal peduncle depth 3½ to 3⅞, pectoral 1¼ to 1⅓, slender spine flexible terminally, outer edge smooth, inner edge with about 20 very short denticles, ventral 1⅗, to 1⅔, adipose fin long, low, 3 to 3⅖ in combined head and body, caudal 3 to 3⅓, greatly forked, lobes slender. Uniform brownish above, dull silvery reflections on sides and lower surface pale grayish Fins very pale brownish Dorsal, adipose fin and caudal with grayish Maxillary barbels dull brown, mentals whitish Length 200 to 225 mm

Three from the Rio de la Plata

Also a large dry example, 885 mm from Buenos Aires

Depth 4⅞, head 4, width 1⅗, snout 2; eye 17, 8 in snout, 4 in interorbital, mouth width 2⅒ in head, maxillary barbel not quite reaches ventral, outer mental to depressed pectoral tip, inner mental to depressed pectoral tip, inner mental slightly beyond pectoral origin, interorbital 4 in head, inter-occipital space to dorsal buckler 3⅓, caudal peduncle depth 3⅕, ventral 1⅖; adipose fin 3⅖ in combined head and body, caudal 5⅖.

Rhamdia quelen (Quoy and Gaimard)

Depth 4 to 4⅓; head 3¼ to 3⅞, width 1⅞ to 1½; snout 2⅞ to 2¼; eye 6 to 7⅖, 2¼ to 3⅓ in snout, 2¼ to 3 in interorbital, mouth width 2⅕ to 2⅓ in head, teeth in villiform bands in jaws in 4 to 6 irregular series; vomer toothless, maxillary barbels to ventral origin in adult, to middle of anal or caudal base in small examples, outer mental barbel to pectoral origin in adult, to depressed pectoral end in smaller examples; inner mental barbel not to gill-opening, to pectoral origin in small examples, front nostril close to snout end, hind nostril at last ⅔ in snout, interorbital 3 to 3⅓, very slightly convex; frontal fontanel not extending beyond level of hind eye edges; interoccipital space to dorsal buckler 3⅔ to 5 in head; opercle finely striate Rakers 4 + 8, lanceolate, rather robust Humeral process covered with thin skin, 2¼ to 2⅔ in depressed pectoral Cluster of pale pores at interorbital and another at opercle below D I, 7, I, smooth slender spine 2⅞ to 3⅓ in head, first ray 1⅗ to 2¼, adipose fin 3⅕ to 3⅓ in combined head and body; caudal 3⅖ to 4¼, deeply forked lower lobe usually longer; A. IV, 7, I, first branched ray 2⅕ to 2⅔ in head, caudal peduncle depth 2¾ to 3, pectoral 1⅓ to 1⅔, ventral 1⅗ to 2⅕ Back and upper surfaces brown, below on head and abdomen whitish Iris brownish. Maxillary barbels brown, mentals white Fins brownish to dusky, paired ones little paler basally Length 170 to 278 mm.

Three from Rio de la Plata

Heptapterus mustelinus (Valenciennes)

Depth 9⅗ to 9⅞; head 5⅕ to 5⅓, width 1⅔ to 1⅓, snout 2⅗ to 2¾; eye 5⅗ to 6⅗, lids not free, 2⅕ to 2⅗ in snout, 1⅓ to 1⅔ in interorbital; mouth width 2¼ to 2⅓ in head, villiform teeth in broad bands in jaws, of 5 or 6 irregular series, palate edentulous; maxillary barbels to first third or middle of pectoral, outer mental barbel not quite or to pectoral origin, inner mental barbel only slightly shorter, front nostril close to front snout edge, hind nostril at last third in snout, interorbital 4¾ in head, flattened, frontal fontanel not extending beyond eyes, occipital process very short, interoccipital space greater than head, which entirely covered with thin skin above Rakers 2 + 6, short, lanceolate. D I, 6, I, slender flexible spine 2 to 2¼ in head, second ray 1⅔ to 1⅗, A IV, 14, I, first branched ray 2⅕ to 3, adipose fin slightly less than half total length, adnate with caudal, caudal peduncle depth 3⅕ to 3⅗ in head; caudal 1⅓ to 1⅗, obliquely rounded behind, with supero-median rays longest, pectoral 1⅗ to 1⅗, spineless, rounded; ventral 1⅗ to 1¾, vent between middle of depressed ventrals Largely brown, paler to creamy or whitish below on head and abdomen Broad deeper brown band across postoccipital region. Dark brown blotch close before dorsal and another close before adipose fin Dorsals and caudal grayish, other fins whitish Maxillary barbels brown, mentals whitish. Length 138 to 148 mm.

Two from Rio de la Plata

Pimelodus albicans (Valenciennes)

Depth 3⅗ to 4⅕, head 3 to 3¾, width 1¼ to 1⅓, snout 2⅒ to 2⅗; eye 4 to 10¾, 1½ to 5⅗ in snout, 1 to 4⅗ in interorbital; mouth width 2⅗ to 2⅞ in head; teeth villiform, in broad bands in jaws of 5 to 10 irregular series, 2 small rounded approximate patches of villiform teeth on vomer, often rudimentary or absent in young; maxillary barbels to anal origin in young, larger with age, to caudal base in some examples, outer mental barbel to middle of depressed pectoral in young, to tip of fin with age; inner mental barbel not quite to gill-opening in young, to pectoral origin with age, front nostril close to snout edge, hind one short slit at first third in snout; interorbital slightly convex, 2⅓ to 3⅗ in head, cranial bones, opercles, humeral plate and dorsal buckler rugose with age, frontal fontanel reaches base of occipital process in young, reaches hind eye edge with age. Rakers 6 + 17, lanceolate, slender. Humeral process 1⅘ to 2 in depressed pectoral fin D. I, 6, smooth spine 1⅗ to 1⅘ in head, first ray 1⅓ to 1½, A. v, 8, i, first branched ray 1⅔ to 2⅕, caudal peduncle depth 3¼ to 3⅓; caudal 1 to 1⅕, strongly forked, upper lobe longer with age, pectoral 1⅕ to 1⅗, outer and inner edges of spine finely serrated, ventral 1⅗ to 2, adipose fin 1⅔ in adult, little greater than head or 3⅘ in combined head and body. Back and upper surface brown, with silvery reflections on sides of head On sides brown color sharply defined in adult from whitish of lower surface, also parallel whitish line along lateral line Fins mostly brownish terminally Lips whitish Iris brown Maxillary barbel brown, also outer mental of adult, all mentals white in young Length 83 to 348 mm

Ten from Rio de la Plata

Pimelodus clarias (Bloch)

Depth 4; head 4, width 1⅓, snout 2; eye 6⅗, 3¼ in snout, 2⅕ in interorbital, mouth width 3 in head, maxillary barbel reaches adipose fin origin, outer mental to pectoral middle, inner mental ⅘ to pectoral origin, interorbital 3⅓ in head, frontal fontanel extends opposite hind eye edges, cranium, dorsal buckler and humeral process finely rugose-striate, as finer radiating striae on opercle. D II, 6, second spine entire, compressed, 1⅓ in head, first ray 1⅘; adipose fin 1¼, A ii, 8, first branched ray 2; caudal peduncle depth 2⅗, caudal 1, widely forked, pectoral 1½, compressed spine with outer edge slightly roughened but not distinctly denticulate, inner edge with row of small imperfect denticles, ventral 1⅗ Back and above brown, below pale to whitish Fins brownish Maxillary barbels brown, mentals white Length 366 mm

Buenos Aires Differs from *Pimelodus valenciennis* in its much narrower cranium, or interorbital 4⅓ (compared with 3⅘)

Pimelodus valenciennis (Lütken)

Depth 4⅓; head 3⅗, width 2, snout 2⅕; eye 6, 2⅓ in snout, 2⅘ in interorbital; mouth width 3⅓ in head, narrow bands of fine teeth in jaws each in 3 or 4 irregular series; palate edentulous; maxillary barbels reach anal, outer mental ⅘ of depressed pectoral, inner mental to middle of depressed pectoral, front nostril close to upper snout edge, hind one at last ⅘ in snout, cranium, interdorsal bridge and humeral process finely rugose, frontal fontanel not extended behind eyes. Rakers 20 + 53, lanceolate, slender Humeral process 2⅓ in depressed pectoral fin D I, 6, compressed spine with front edge smooth, hind edge with fine antrorse serrae, spine 1⅗ in head, first ray 1⅓; A. iv, 13, i, first branched ray 2, adipose fin 1⅓, caudal peduncle depth 2⅞, caudal 1, sharply forked, pectoral 1¼, compressed spine finely serrated on both edges, serrae 38 on outer edge, ventral 1⅗ in head Back brown, with silvery sheen on sides, below whitish Fins all pale brownish, paired ones with whitish Maxillary barbel brown, mentals pale brown Length 225 mm

One from Rio de la Plata

Pseudoplatystoma coruscans Agassiz

Depth 5⅒, head 3⅗, width 1⅞, snout 2, orbit 18, 9 in snout, 5 in interorbital, mouth width 2⅗ in head, maxillary barbel reaches little beyond eye or only 2 in head, outer mental 2⅗, inner mental 3¼; interorbital 3⅗, frontal fontanel extends orbital length beyond hind eye edge, cranium weakly striate D I, 6, first ray (damaged) 3 ? in head, adipose fin length 4, A v, 9, i, first branched ray 3¾, caudal peduncle depth 5½, caudal 3, lobes deeply separated by median notch behind, rounded, rays greatly expanded, pectoral 2¾, smooth slender spine 1½ in fin, ventral 3 in head Brown above, paler below All of trunk and tail above and on sides with dusky-olive spots, rather regular, smaller than interspaces and those on sides of back more or less joined or as short horizontal bars All fins with smaller and much more numerous blackish spots, especially terminally on fins Head without spots Barbels brown Length 2130 mm

Buenos Aires

Pterodoras granulosus (Valenciennes)

Depth 4¼, head 4⅓, width 1; snout 3; eye 12½, 5 in snout, 5 in interorbital, mouth width 2½ in head, maxillary barbel reaches first ¼ of pectoral, outer mental about ⅓ to pectoral origin, inner mental slightly shorter, broad bands of villiform teeth in jaws, in about 8 to 10 irregular transverse series, interorbital 3 in head, frontal fontanel extends back little behind hind eye edge; cranium, dorsal buckler and humeral process rugosely striate, also suborbitals and small upper portion of opercle, humeral process 1⅓ in pectoral spine. Lateral line with 26 keeled bucklers D II, 5, i, second spine with 57 spines along front edge, terminally largest and best developed, only about 7 imperfect small denticles along hind edge medially, second spine 1¼ in head, adipose fin 3⅓, A iv, 8, i, first branched ray 1⅓, caudal peduncle depth 4⅓; caudal 1⅓, broadly bilobate with hind edge little incised, pectoral spine 1⅓, outer antrorse serrae 55 or 56, inner 38 to 40, ventral 1⅗ in head. Dark brown above, belly and under surface of head paler Fins all brownish. Length 594 mm.

Buenos Aires.

Loricaria anus Valenciennes.

Depth 7⅓, head 4¾, width 1⅒, snout 1⅗, eye 8½, 5 in snout, 3 in interorbital; mouth width 4⅕ in head, interorbital 3⅓ Bony bucklers 34 + 2 in lateral line, of which last 4 in caudal peduncle side form single ridge, 4 predorsal, 23 postdorsal D. I, 7, slender spine about equals head, A I, 5, second branched ray 1⅓, caudal peduncle depth 6⅓, caudal emarginate, (damaged) 1⅓ ?, pectoral 1⅓, ventral 1. Uniform brownish, belly and under surface of head paler Length 517 mm

Buenos Aires

Menidia argentinensis (Valenciennes)

Depth 6 to 7, head 4 to 4⅗, width 2⅓ to 2½, snout 3⅓ to 3½, eye 3¼ to 3½, 1 to 1⅕ in snout, maxillary 3⅗ to 3⅔ in head, lower jaw slightly included in upper, teeth in bands in jaws, small, in 3 or 4 irregular transverse series, no vomerine teeth, interorbital 3½ to 4 in head, broadly convex Rakers 6 + 15, lanceolate Scales 46 to 51 + 5 or 6 in median lateral series, 11 transversely at spinous dorsal and anal, predorsal 37 to 39, 17 to 19 basal bracket-like circuli, apically scales smooth or abraided D IV or V—II, 8, I or 9, I, second spine 3 to 3⅗ in head, first branched ray 1⅞ to 2⅛, spinous fin inserted slightly behind anal origin, A II, 13, I to 15, I, first branched ray 1⅘ to 2, caudal peduncle depth 2½ to 2¾, caudal 1 to 1⅕, well forked, pectoral 1⅕ to 1⅓, not reaching ventral, which 1⅗ to 1⅞ Pale brownish, generally uniform Sides of head and iris silvery Broad silvery band one scale in width from pectoral axil to caudal base medially, with gray marginal line above. Fins all pale, dorsals and caudal with grayish tint Length 55 to 80 mm.

Seven from Rio de la Plata These agree with Evermann and Kendall's figure of *Odontesthes perugiae*[4] It is quite evident that this nominal form and *Atherinichthys platensis* Berg are synonyms of *Atherina argentinensis* Valenciennes The nominal species grouped under *Austromenidia* Hubbs seem to me to best fall with *Odontesthes* Evermann and Kendall

Menidia bonariensis (Valenciennes)

Depth 6¼, head 3⅞, width 1⅞, snout 2$\frac{9}{10}$ from snout tip, eye 8, 2⅘ in snout, 2⅓ in interorbital; maxillary reaches first third in eye, 2⅗ in head, bands of fine conic teeth in jaws, in 5 or 6 transverse irregular rows above and 7 or 8 below, interorbital convex, with median depression, 3⅗ in head Scales 55 from shoulder to caudal base, 14 transversely between anal origin and spinous dorsal, 52 predorsal; 100 to 105 basal bracket-like circuli, apically scales abraided. D. V—II, 8, I, first spine 4⅓ in total head length, first branched ray 2¾, A. II, 17, I, first branched ray 2⅗; spinous dorsal almost entirely placed before anal; caudal peduncle depth 4¼; caudal 1⅗, forked, pectoral 1⅕; ventral 2⅗ Largely uniform dull brownish Fins all pale like body. Length 558 mm.

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[4] Proc U S. Nat. Mus., 31, 1906, p 94, fig 3

Buenos Aires

Mugil brasiliensis Agassiz

One 520 mm. Buenos Aires Soft dorsal and anal scaleless.

Sarda sarda (Bloch)

One 512 mm Buenos Aires. Typical of the species, with 21 dorsal spines

Stromateus maculatus Valenciennes.

Depth 2⅓; head 5, width 1¼; snout 3⅓; eye 4⅓, 1⅜ in snout, 1⅞ in interorbital, maxillary 3⅓ in head; interorbital 2¼, convexly elevated D VII, 38 ?, first branched ray 1¼ in head, A III, 35, first branched ray 1¾, caudal peduncle 2¼, pectoral 4⅓; caudal 4 in combined head and body, forked. Brown above, pale below, evidently whitish. Back with many close-set darker brown ellipsoid blotches, their long axes horizontal. Fins brownish. Length 363 mm

Buenos Aires Evidently the specimen I described from Rio Grande do Sul, Brazil, as *Stromateus brasiliensis*[5] is the same.

Seriola rivoliana Valenciennes.

Depth 5; head 3¾, width 2; snout 2¼ from snout tip, eye 7, 2¼ in snout, 2⅗ in interorbital, maxillary reaches slightly beyond eye front, 2⅗ in head, expansion equals orbit; interorbital 3 in head. Cheek with 14 rows of scales. Preopercle ridge and front of opercle finely striate. D VII—II, 19 ?, third spine 7 in total head length; first branched ray 2⅓, A. II—III, 15, first branched ray 2⅗; caudal peduncle depth 5⅓, caudal 1¼, strongly forked, lobes slender; pectoral 1⅗; ventral 2⅕ Back olivaceous, below pale. Fins all dull brownish Dark shade, apparently traces of dark band from nape through eye to preorbital Length 813 mm.

Buenos Aires This specimen evidently abnormal in its few dorsal rays, usually given as 28 to 30, the anal 19 to 21.

Parona signata (Jenyns)

Depth 2¼ to 2⅗; head 3¾ to 4, width 1⅗ to 2⅓; snout 3⅓ to 3¾ from snout tip; eye 5⅓ to 5⅗, 1⅗ in snout, 1⅗ in interorbital; maxillary 1⅕ in head, expansion 1 to 1$\frac{1}{10}$ in eye, reaches well beyond eye; bands of fine, conic, simple teeth in jaws, in 4 or 5 irregular series; interorbital 3⅗ to 4 in head, convexly elevated. Rakers 8 + 15, slender, lanceolate. Scales 143 along lateral line to caudal base, 38 above to soft dorsal origin, 70 below to soft anal origin; cycloid, circuli 17 to 34 D VI, II, 35, I or 36, I, first branched ray 1⅔ in total head length; A II—II, 33 to 35, I, first branched ray 1⅔ to 1⅘, caudal peduncle depth 3⅘ to 4; pectoral 1⅓, caudal 2⅗ to 2⅞ in combined head and body Back dark drab-brown till midway on side, lower half silvery-white Vertical fins more or less brownish, dorsal darker terminally Pectoral dull brownish Elongate black horizontal blotch at lower bases of pectoral rays, 1⅗ in pectoral fin. Length 316 to 450 mm

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[5] Proc Acad Nat. Sci. Phila., LVIII, 1906, p. 116, fig 2.

Buenos Aires, larger dry skin

Pomatomus saltatrix (Linné)

Two from Buenos Aires, 317 to 630 mm , larger dry skin

Percichthys trucha (Valenciennes)

Depth 3⅗; head 3⅖, width 2; snout 3⅓; eye 5⅖, 1⅞ in snout, 1⅜ in interorbital; maxillary reaches opposite eye, expansion 2 in eye, length 3⅜ in head, teeth in bands in jaws, in 6 or 7 irregular series, fine bands also on vomer and palatines, interorbital broadly convex, 4⅓ in head; preopercle edge and free preorbital edge finely denticulate Muzzle, interorbital, mandible and lower preopercle flange cavernous. Rakers 7 + 14, lanceolate Scales 64 + 3, 10 above, 18 below, 52 predorsal, 15 rows on cheek to preopercle ridge, 14 basal parallel striae, apical denticles 40 to 42 with 10 or 11 transverse series of basal elements and circuli moderately coarse D X, I, 12, fourth spine 1½ in head, third ray 2, A. III, 9, I, second spine 2⅘, second ray 1⅞, caudal peduncle depth 2⅓, caudal 1⅓, slightly emarginate, truncate as expanded, pectoral 1½, ventral 1⅗ Brown above, white below On back and upper surface of head base of each scale with small deep brown spot Dorsals and caudal gray-brown, finely spotted with deep brown Anal whitish, with few small brown spots. Paired fins whitish Length 280 mm

Rio Negro, Patagonia

Acanthistius patachonicus (Jenyns)

Depth 2⅘ to 3⅓; head 2¼ to 2⅓, width 2 to 2¼, snout 4⅓ to 4⅗ from snout tip, eye 4⅗ to 5, 1 to 1⅓ in snout, maxillary reaches opposite hind pupil to hind eye edge, expansion 1⅓ to 1⅘ in eye, length 2⅓ to 2½ in head; teeth in bands in jaws, on vomer and palatines, fine, villiform; 4 to 6 anterior outer short upper canines and 3 to 5 medially on each ramus externally, interorbital 6⅓ to 7⅘ in head, very slightly convex, 1⅓ to 1¾ in eye; 29 to 33 denticles along hind preopercle edge and 3 antrorse spines below. Scales 78 + 7, tubes 45 + 1, 20 scales above, 28 below, 57 predorsal, 23 rows across cheek; 8 to 10 basal radiating striae, 12 or 13 apical denticles with 3 or 4 transverse series of basal elements, circuli coarse D. XIII, 14, I or 15, I, fourth spine 2⅓ to 2⅗ in total head length, fifth ray 2⅗ to 2⅓; A. III, 7, I, second spine 3, third ray 2⅓, caudal peduncle depth 3⅗ to 4; caudal 1⅓ to 1⅖, convex behind; pectoral 1⅗ to 1¼, ventral $2\frac{1}{10}$ to $2\frac{1}{3}$. Largely dark drab-gray, scarcely paler below. Trunk and tail with dark or dusky reticulating lines, these also extending on vertical fins Dusky blotch between upper and median opercular spines marginally Dorsals brown Caudal and anal dusky-brown Paired fins dusky terminally, medially pale olivaceous Iris dull grayish Length 200 to 325 mm

Buenos Aires, larger, dry skin

Sparus pagrus Linné

Depth $2\frac{1}{3}$ to $2\frac{2}{3}$, head 3, width 2 to $2\frac{1}{4}$, snout 2 to $2\frac{1}{4}$, eye $4\frac{1}{4}$ to $4\frac{3}{5}$, 2 to $2\frac{1}{5}$ in snout, $1\frac{1}{3}$ to $1\frac{1}{2}$ in interorbital, maxillary not quite to eye, $2\frac{1}{3}$ to $2\frac{3}{4}$ in head, 4 canines in front of each jaw, 2 rows of molars in each jaw, hind nostril oblique slit, nearly 3 times front one, which $\frac{3}{4}$ of eye-diameter before front of eye, interorbital $3\frac{2}{5}$ to $3\frac{3}{5}$ in head, convexly elevated, preopercle edge entire Rakers 7 + 9, short, compressed, robust points Scales 52 ? to 57 to caudal base, 7 above lateral line, 14 or 15 below, 46 predorsal forward to occiput, 7 rows on cheek, 10 basal radiating striae, 110 to 133 apical denticles with 10 to 14 transverse series of basal elements, circuli fine D XII, 10, I, third spine $2\frac{1}{5}$ in head, third ray $2\frac{7}{8}$, A. III, 8, I, third spine $3\frac{1}{4}$ to $3\frac{2}{3}$, first ray $2\frac{7}{8}$ to $3\frac{1}{2}$, caudal peduncle depth $3\frac{1}{8}$ to $3\frac{1}{3}$; caudal 1, deeply forked, ventral $1\frac{4}{5}$ to 2, pectoral $2\frac{3}{5}$ in combined head and body Body largely silvery, back pale brown, sides and below whitish Dorsal and caudal pale, paired fins and anal whitish Length 328 to 438 mm.

Two from Buenos Aires, larger dry skin

Cynoscion striatus (Cuvier)

Depth $4\frac{3}{5}$, head $3\frac{1}{5}$, width $2\frac{1}{3}$, snout $4\frac{1}{4}$ from snout tip, eye $5\frac{3}{5}$, $1\frac{1}{5}$ in snout, little greater than interorbital; maxillary reaches opposite hind eye edge, expansion $1\frac{3}{5}$ in eye, length $2\frac{1}{5}$ in head, interorbital $5\frac{3}{5}$, slightly convex, opercular flap very blunt Scales about 72 ? along lateral line to caudal base, tubes 48, 8 scales above, 7 below, 43 ? predorsal, 32 to 35 basal parallel marginal striae, 47 to 50 weak apical denticles with 18 to 20 series of basal segments transversely, circuli fine D X, 20, second spine $2\frac{3}{5}$ in total head length, third branched ray 3, A II, 9, I, second spine 9, second ray $3\frac{1}{4}$, caudal peduncle depth $4\frac{1}{5}$, caudal 2, truncate; pectoral $2\frac{1}{5}$, ventral $2\frac{3}{5}$ Light brown. Each row of scales on back with median deep brown line or streak, all slightly inclined and cross lateral line until below middle of soft dorsal, become horizontal on tail and caudal peduncle. Fins pale, soft dorsal and caudal with obscure mottlings of darker Length 470 mm.

Buenos Aires.

Sagenichthys ancylodon (Schneider)

Depth $4\frac{7}{8}$; head $3\frac{1}{3}$, width 2; snout 4 from snout tip, orbit $5\frac{1}{3}$, $1\frac{1}{5}$ in snout, $1\frac{2}{5}$ in interorbital, maxillary reaches $\frac{3}{5}$ in eye, expansion

1⅓ in eye, length 2⅓ in head; interorbital 4⅔, slightly convex Squamation injured D XI, 27, I, A I 9, I, with median rays longest, forms angle behind, caudal peduncle depth 3⅔ in total head length; paired fins small, (damaged) apparently less than half of head Brown above, pale or light below, evidently with silvery sheen Length 328 mm

Buenos Aires, poor dried example

Micropogon opercularis (Quoy and Gaimard)

Depth 3⅔ to 4⅒, head 3¼ to 3½, width 1⅘ to 2, snout 3⅛ to 3⅔, eye 6 to 6½, 1¾ to 2 in snout, 1½ to 1⅔ in interorbital, maxillary reaches slightly beyond front of eye to ⅔ in eye, 3 to 3⅒ in head; bands of fine conic teeth in jaws, outer row enlarged, 5 mandibular pores, interorbital 3⅔ to 4⅒, broadly convex; preopercle edge with 6 denticles, largest at angle bent down, 1 below little smaller and similar Rakers 10 + 14, lanceolate Scales 55 to 58 + 4, tubes 48 to 51 + 7 or 8 scales above, 8 to 10 below, 40 predorsal of which 16 to 17 to occiput, 11 to 16 basal radiating striae, 43 to 53 apical denticles with 14 or 15 series of basal elements transversely, circuli fine D X, I, 27, I or 28, I, third spine 2⅒ in head (fourth spine 2⅒), first ray 3 (second ray 3⅔), A II, 8, I, second spine 4 to 4½, second ray 2⅔, caudal peduncle depth 3¼ to 4, caudal 1⅔ to 1⅞, obtusely angular from median rays which longest, pectoral 1¼ to 1⅔; ventral 1⅔ to 1⅞ Back drab gray, below silvery white Back with silvery and iridescent reflections, darker streaks on rows of scales above lateral line, at first oblique and at tail horizontal On costal region about 8 to 10 obliquely vertical diffuse streaks Iris silvery Dorsals and caudal pale brownish, slightly dusky-gray terminally Fins otherwise whitish Length 346 to 512 mm

Two from Buenos Aires, larger dried skin

Pogonias courbina (Lacépède)

Depth 3⅔, head 3⅔, width 1⅔, snout 3, orbit 8, 3 in snout, 2⅔ in interorbital, maxillary reaches little beyond front eye edge, expansion equals eye, length 2¼ in head, teeth in bands in jaws, in 7 or 8 transverse irregular rows, 7 or 8 barbels along each mandibular ramus, front nostril at last ⅔ in snout, hind one larger and little closer to front one than to eye, interorbital 3, convexly elevated Scales 50 + 7, 7 above, 10 below, 45 predorsal; 18 to 20 imperfect, largely parallel basal striae, circuli fine D X, I, 19, I, third spine 2¼ in head, second ray 3, A II, 6, I, second spine 3⅔, second ray 2¼, caudal peduncle depth 3⅔, caudal 1⅔, truncate; pectoral 1⅙, ventral 1¾ Largely uniform brownish, paler below. Length 1118 mm.

Buenos Aires, dry skin Apparently distinguished from *Pogonias cromis* in its fewer dorsal rays (19 compared with 21 to 23)

Chilodactylus macropterus (Schneider)

Depth 2⅗ to 2⅞; head 3¼ to 3⅜, width 1¾ to 2⅛, snout 2⅝ to 2¾; eye 3⅔ to 3⅞, 1¼ to 1⅓ in snout, little greater than interorbital, equal in larger example; maxillary reaches opposite front nostril, 3⅓ to 3⅝ in head, teeth in bands in jaws, in 4 or 5 irregular series and outer row little enlarged, compressed, slender, pointed, interorbital 3⅔ to 4⅛, slightly convex Rakers 5 + 15, lanceolate Scales 50 to 52 + 2, 7 above, 13 below, 38 predorsal, extending slightly before front nostril or to last third in snout, 8 to 17 basal radiating striae with 0 to 8 auxiliaries, circuli fine D. XVI or XVII, 25, I to 27, I, sixth spine 1⅝ to 2⅛ in head, first branched ray 3⅓ to 3½, A III, 13, I, second spine 3½ to 4⅛, second ray 2⅞ to 3, caudal peduncle 3⅛ to 3⅓, caudal 1, deeply forked, lobes slender; ventral 1⅓ to 1⅝, pectoral II, 7 + 6, 2⅛ to 2⅓ ? in combined head and body Back brown, with soiled appearance on sides and below. Borders of scales slightly darker than centers, though form indistinct longitudinal pale bands on sides Fins dull brown. Inside gill-opening blackish Length 275 to 314 mm.

Buenos Aires, two examples, larger dried skin

Helicolenus dactylopterus (Delaroche)

Depth 3⅝; head 2¾, width 2, snout 4, orbit 3⅖, maxillary reaches middle of orbit, expansion 2 in orbit, length 2 in head; bands of fine conic teeth in jaws, interorbital 4⅔, concave, small nasal spine above front nostril, antero-supraocular spine small, postero-supraocular followed by 2 small ones, then long parietal followed by small nuchal, 2 broad, blunt preorbital spines, small infraocular spine on suborbital stay, preopercle with 5 spines Scales 65 + 5, tubes 45 + 2 ?, 9 scales above lateral line, 16 below, 10 predorsal, 18 or 19 basal radiating striae, 15 to 30 short-apical denticles, circuli fine D XII, 12, I, fifth spine 3 in head, second branched ray 2¾ ?; A III, 5, I, second spine 3⅓, second ray 2⅝, caudal peduncle depth 4⅗, caudal 1⅔, emarginate, pectoral 1⅞, ventral 2 Pale brown Back and sides speckled with dark brown, also some few similar markings on dorsals. Pectoral, caudal and anal with some faint brown spots. Length 329 mm.

Buenos Aires

Prionotus punctatus (Bloch)

Depth 4⅓ to 4⅝, head to hind edge of opercular flap 2⅝ to 2⅞, width 1⅓ to 1¾; snout 2 to 2$\frac{1}{10}$, eye 5⅓ to 6¼, 2¾ to 3½ in snout, 1 to 1⅛ in interorbital, maxillary not reaching eye, expansion 1⅝ to 1⅘ in eye, length 2⅓ in head; teeth in bands in jaws, in 7 or 8 irregular series, interorbital concave, equals eye; preopercle spine long as orbit; opercular spine long and slender; humeral spine strong, also long as orbit. Rakers 5 + 8, lanceolate. Pores 48 + 5 in lateral line, 8 scales above to soft dorsal origin, 21 below, 12 predorsal;

5 or 6 basal radiating striae, 22 to 30 apical denticles with 4 or 5 series of transverse basal elements, circuli fine. D. X, 12, second spine 2 in head, second ray 2⅗, A 11, third ray 3¾, caudal 1⅗ to 1⅔, truncate, caudal peduncle depth 4⅗ to 5⅓, ventral 1⅓ to 1⅗; pectoral 2⅓ to 2¾ in combined head and body, rays 13 + 3 Back mauve-brown, largely uniform, whitish below Several transverse brown streaks across interorbital Spinous dorsal brownish, with deeper cloudings Soft dorsal with 4 rows of deep brown spots Caudal with 4 or 5 rows of dark brown spots. Pectoral neutral dusky, clouded or obscurely blotched with darker Ventral and anal whitish Length 248 to 296 mm

Two from Buenos Aires, larger dried skin. This species is evidently the same as *Prionotus capella* Miranda Ribeiro [6]

Paralichthys brasiliensis Quoy and Gaimard

Depth 2¼ to 2⅝, head 3¾ to 4⅛, width 3⅓ to 3¾, snout to lower eye 4 to 4¾ in head from snout tip, lower eye 6 to 6⅗, 1½ to 1¾ in snout, maxillary extends to hind edge of lower eye or beyond, expansion 1 to 1¼ in lower eye, length 2 to 2⅛ in head; teeth uniserial, with front lower pair canines, right teeth slightly larger, interorbital 7¾ to 8, about 1⅛ in eye, slightly convex Rakers 4 + 14, lanceolate. Scales 96 to 98 + 8 ?, above arch 14, below straight section 30, arch of lateral line 3⅓ to 3⅗ in straight section to caudal base; 18 basal radiating striae, circuli fine D 72 to 77, height 2¼ to 2¾ in total head length, A 57 or 58, height 2¼ to 2⅗, caudal 1 to 1⅛, obtuse behind; pectoral 2¼ Right or left side deep brown, somewhat clouded, other side whitish. Fins on colored side more brownish, mottled paler and darker. Length 274 to 603 mm

Two from Buenos Aires, larger dry skin

Phycis brasiliensis Kaup

Depth 4⅗; head 4⅗, width 1¾; snout 3¼, eye 6¼, 1⅗ in snout, 1⅓ in interorbital, maxillary reaches back well beyond eye, 2 in head; interorbital 4⅗, little convex. Scales very small, thin, closely adherent. D 10—59, third ray of first dorsal filament long as head, height of second dorsal 2⅓, A 48 ?, height 3⅓, caudal 2, pectoral 1⅗, ventral filamentous, reaches beyond front of anal, 2⅗ in combined head and body, shorter filament half of outer Back brown, below pale Fins brownish Length 503 mm.

Buenos Aires.

Genypterus blacodes (Schneider).

Depth 7¾; head 4⅗, width 2⅓, snout 4; eye 8¼, 2⅓ in snout, 1⅓ in interorbital; maxillary extends slightly beyond eye, expansion 1¾ in snout, length 2⅓ in head, interorbital 6, level; opercle with strong horizontal spine. Dorsal begins over last third of depressed pectoral, anal begins little nearer front eye edge than caudal base; caudal 4⅓ in head, pectoral 2⅗. Back blotched olive brown, below pale Length 731 mm.

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[6] Arch. Mus. Nac. Rio Janeiro, 17, 1915, (Triglidae), p 4.

Buenos Aires

Merluccius gayi Guichenot

Depth 7⅓, head 3⅔, width 2⅓; snout 3 from snout tip; eye 6⅓, 2 in snout, 1⅔ in interorbital, maxillary reaches opposite eye center, expansion 2¼ in eye, length 2⅒ in head, interorbital 4⅓, broadly depressed Scales thin, largely fallen. D 9, 37, third ray of first dorsal 2⅓ in total head length, third ray of second dorsal 4⅓, fifth ray of third dorsal 3, A 30, fifth ray of first anal 5, fifth ray of second anal 3⅞, caudal peduncle depth 6⅔, caudal 3, truncate, pectoral 2, ventral 2⅗ Back olive brown down till level with pectoral base, then lower surface all contrasted lighter or whitish Dorsals and caudal brownish, lower fins pale. Length 742 mm.

Buenos Aires

Percophis brasiliensis Quoy and Gainard

Depth 10 to 13¼, head 4⅛ to 4⅓, width 2⅓ to 2⅗, snout 3⅔ to 3¾ from snout tip, eye 7 to 7⅓, 1¾ to 2¼ in snout, 1 to greater than interorbital, maxillary to first ⅔ or middle of eye, expansion 2 in eye, length 2¾ to 2⅘ in head, teeth conic, in bands in jaws, on vomer and palatines, outer row of jaws and palatines little enlarged, 4 upper front canines, 4 lower anteriorly little smaller and lateral lower teeth canine-like posteriorly, interorbital 7⅓ to 8¾, or 1⅓ in eye, flat Rakers 5 + 17, lanceolate, with 2 or 3 small asperous knobs above and below Scales 112 + 6, 10 above to spinous dorsal origin, 20 below, 59 predorsal, 10 to 13 basal radiating striae, 28 to 30 apical denticles with 7 series transversely of basal elements, circuli fine D IX, 32, second spine 2¾ to 3 in total head length, second ray 3 to 3⅓, A 42, eighth ray 5, caudal 2, truncate or slightly oblique behind, lower rays little shorter; caudal peduncle depth 5⅓ to 6⅓, pectoral 1⅘, ventral 2⅕ Back and upper surface uniform dull brown, below white Dorsal and caudal gray brown. Pectoral brown above, whitish below Ventral and anal whitish. Length 328 to 559 mm

Two from Buenos Aires, larger dry skin

Pinguipes brasilianus Cuvier

Depth 4⅓, head 3⅔, width 1⅘; snout 2⅔; eye 5, 2 in snout, 1⅒ in interorbital; maxillary reaches opposite front eye edge, 2⅔ in head, lips broad, fleshy, teeth in bands in jaws, with outer row greatly enlarged, strong and conic and inner band of 4 or 5 irregular series; band of rather short, broadly conic large teeth on vomer and palatines, interorbital 4⅔, slightly convex; preopercle edge entire. Rakers 8 + 12, lanceolate, rather robust. Scales 103 along lateral line to caudal base, pores 77 + 15 ?, 24 scales above lateral line, 24 below, 22 predorsal to occiput and 14 more forward opposite middle of eye, 11 or 12 basal radiating striae, 30 to 40 apical denticles with 3 to 6 transverse series of basal elements, circuli rather coarse D VII, 26, seventh spine 3⅗ in total head length, third ray 2¾, A 25, sixth ray 2½; caudal 1⅞, slightly convex behind, caudal peduncle depth 2⅗, pectoral 1⅓, ventral 1⅓ Brown above, paler to whitish below Back with 8 darker transverse bands, with narrow alternate parallel band between each Iris grayish Dorsals, anal and caudal gray brown, darker or dusky terminally or marginally Dusky-brown ellipsoid blotch at bases of median superior rays, slightly longer than eye Paired fins pale, little grayish terminally Pectoral brown basally Length 267 mm

Buenos Aires Mirando Ribeiro gives a good figure,[7] though it does not show the caudal dark blotch

Pseudopercis numida Miranda Ribeiro

Depth 5⅛, head 3⅞, width 1⅗, snout 2¼ from snout tip, eye 6¼, 2⅓ in snout, 1⅛ in interorbital, maxillary reaches ¾ to eye, 2⅓ in head, teeth conic, in bands in jaws, fine, in 4 to 6 irregular series transversely and outer row of enlarged uniform conic teeth, front nostril small, at last third in snout, and hind one greatly larger, nearer front one than eye, interorbital 5, scarcely elevated and with median depression, preopercle edge rather firm, subcrenulate Scales 107 along lateral line to caudal base, tubes 78, 17 scales above lateral line, 30 below, 48 predorsal forward opposite middle of eyes, 18 transversely across cheek, 25 to 30 parallel striae basally, circuli fine. D V, 26, fifth spine 4½ in total head length, fifth ray 2⅗, A I, 23, fifth ray 2¾, caudal 1¾, truncate, caudal peduncle depth 3⅛, pectoral 1⅔, ventral 1⅞ Uniform light brown generally, back and upper surface of head slightly darker Head above, back and upper sides with dusky-brown spot on each scale Dorsals and caudal slightly darker than other fins and latter with indistinct small spots scattered everywhere Length 877 mm

Buenos Aires Although Miranda Ribeiro described this species with pale or whitish spots, fancifully like those of the guinea fowl, there is little doubt that in my example, a dried skin, they have dried dark

Chile

The fishes from Chile were an exhibition of dried mounted specimens from Valparaiso in the Commercial Museum, Philadelphia As Chilean fishes are rare in the United States, I have given a few notes on their variation I am indebted to Dr. W P Wilson for the opportunity to study these fishes

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[7] Arch. Mus. Nac. Rio Janeiro, 17, 1915 (Malacanthidae), p 11, Pl.

Poroderma chilense (Guichenot)

Depth 11⅔, body slender, tapers evenly to long tail, which also slender and tapering, head 6⅔, head and trunk 1⅔ in tail; snout 2⅓ in head, depressed, long as wide; eye 6⅔, center over rictus, mouth large, width 1⅞ in head, length half its width, fold around corner, lower fold half length of jaw and upper shorter, teeth small, median cusp strongest and small basal cusp each side, nostrils near mouth, about first third in profile of snout, front nasal valves short, wide, well separated, notched on hind edge, cirrus rudimentary, hind valves short and wide, interorbital 2⅓ in head. Last 2 gill-openings over pectoral base Spiracle small, behind eye little less than eye-diameter Scales small, tricuspid to granular, median cusp often strong, little larger over eyes posteriorly and down each side of back above Dorsals subequal, first inserted opposite hind inner ventral edge, second dorsal inserted over hind basal anal edge, anal depth nearly half of first dorsal depth, base length greater than that of either dorsal, caudal small, long as head, pectoral 1⅔ to ventral, latter rather short Uniform brown. Length 560 and 572 mm

Two examples, smaller male and larger female

Glyphis glaucus (Linné)

Two examples, larger 773 mm

Squalus acanthias Linné

Male 650 mm and female 560 mm Apparently not different from Atlantic and Mediterranean examples

Raja lima Poeppig

Disk rhomboid, wider than long, snout forming blunt angle in front, snout only very slightly produced, front edges slightly undulate or only little concave medially, outer angles widely convex; eye half of interorbital, teeth $\frac{38}{38}$, median sharper than lateral, cusps more distinct, jaw little undulate; interorbital little over half of snout Spiracle large as eye Lower surface of body smooth, except very fine asperities along front edges, band of small spines spines or thorns along middle part of forward pectoral edges opposite and little behind eyes, disk medially above, outer marginal portions of pectorals and ventrals medially with minute asperities; several small spines before each eye and 3 or 4 behind; short median line of tubercles on front of back soon giving place to double well-spaced vertebral row and again on tail irregular median row of enlarged ones begins and continues to dorsal fin; sides of tail rough; outer hind surface of each pectoral with small thorns. Dorsals near end of tail, separated, tail shorter than disk. Brown above, with traces of darker mottlings. Length 402 to 468 mm.

Two examples, smaller male and larger female.

Raja flavirostris Philippi

Disk rhomboid, wider than long, front angle acute, outer angle not acute or rounded, front edge undulate and outer front edge widely concave, hind disk edge broadly convex, snout acute, 3¼ in disk length, eye 3⅓ in interorbital, latter 2⅓ in snout Tail ⅔ total length Back rough with small spines, longer on head and outer pectoral regions, tail with 3 rows of tubercles, median row begins well before others or opposite pectoral origin; before last each side of median line short row of 3 or 4 spines, 6 low superciliary tubercles, single tubercle on front of back, snout all rough; dorsals separated by pair of tubercles Brownish above, mottled obscurely darker Length 1107 mm

Callorynchus callorynchus (Linné)

Dry skin of male 550 mm

Sardina sagax (Jenyns)

Depth 4, head 3¾; snout 3⅓, eye 4, maxillary 2⅔, reaches opposite front pupil-edge, interorbital 4⅓, opercle with many strong striae, radiating from above, in front, downwards Scales 50 in lateral series, 14 transversely between dorsal and ventral origins D III, 17, origin nearer snout tip than caudal base, A 15, inserted midway between last dorsal ray and caudal base, V I, 6 Length 321 mm.

One example

Ethmidium coerulea (Valenciennes)

Depth 3⅓, body compressed, deepest at dorsal origin, head 3⅓, deep and compressed, snout 4⅔ from snout tip, wide as long, eye 6, placed little before first third in head, maxillary 2⅓, reaches slightly behind eye, width ⅔ of snout, interorbital 4¼ in head, convex, cheek deep, hind preopercle ridge inclined well back Scales 50 in lateral series to caudal base, 15 transversely from dorsal to ventral origin, very narrowly imbricated, deep, smaller on back, edges finely pectinate, abdominal scutes 36 + 18 D. III, 18, inserted little nearer snout tip than last anal ray base, with slight lobe in front, A. II, 14, well behind dorsal though origin little nearer last dorsal ray base than caudal base, fin low, caudal equals head, widely forked; caudal peduncle depth 2⅔; pectoral 1⅔ to ventral, latter inserted below front dorsal rays or nearer pectoral than anal, reaches barely ½ to anal. Olive above, whitish below. Several short, dark, vertical streaks, well spaced and irregular along middle of side. Length 395 mm.

One example

Carassius auratus (Linné)

One example.

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THE RADULA OF PROSERPINA

BY H. BURRINGTON BAKER.

Through the generosity of Dr Pilsbry and Mr Vanatta, I have been able to examine the radulae from two dried-in specimens of *Proserpina depressa* (Orb) from western Cuba, collected by Mr. E E Hand during the summer of 1926 This species is a member of the typical genus of the molluscan family Proserpinidae, which for many years has been considered as a close relative of the Helicinidae, although the only anatomical basis for such systematic disposition has been Gray's[1] impossible figure of what he supposed to be the radula of *Ceres salleana* from near Córdoba, Vera Cruz, Mexico However, one must admit, in the present case, that Dr. Gray's systematic intuition was beyond reproach, even if the technique of his proof may have been somewhat fallacious

The radula of *Proserpina depressa* is very similar to that in the subfamily Vianinae[2] of the Helicinidae, and consists of the same seven fields. a central one with seven teeth, lateral complexes of two plates each, and marginal groups of numerous uncini As my material was considerably decayed, the ribbon from neither animal is complete, one of them shows fifty-three transverse rows, which I believe to be less than half of the entire radula Each transverse row (Text-fig , W), is V-shaped in the central field, as the line of A, B, and C centrals slopes slightly anteriad In contrast, the lateral complex (D and E plates) of each side slopes obliquely backward, while the rows of marginals curve even more markedly posteriad so that their outer ends are almost parallel to the long axis of the ribbon

The rhachidian central (Text-fig , R) is more vestigial than that of any Helicinid I have examined, it consists of a thin plate with parallel sides Its anterior edge is weakly notched and has no sign of a reflection or cusp, although its anterior half is slightly thickened Its posterior edge is very thin, quite irregular and somewhat pointed The A central (A) is smaller than the B plate (B), which is the reverse of their relative sizes in the Vianinae. Otherwise, all of the paired centrals (A, B, C) are similar in shape to those in that group and each develops a simple, heavy, cutting edge, as in the more specialized members of the subfamily

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[1] 1857, Ann Mag Nat. Hist. (2), vol 19, p 184.

[2] H.B.B ; 1922, Proc. Acad Nat. Sci Philadelphia, vol 74, pl 6.

The D plate (Text-fig., D) is a T-lateral with a broadly crescentic reflection (about one-half as deep as wide) and a short, stout stalk. Under dry lenses, its cutting edge appears simple and smooth, but, under an oil-immersion objective, the entire upper surface is seen to be beautifully striate at right angles to its free margin, which, as a result, becomes very minutely serrate in worn teeth. The E plate (E) is relatively larger than, but quite similar in structure to that of most Viaminae, its inner one-fourth is very firmly cemented behind the outer portion of the D lateral

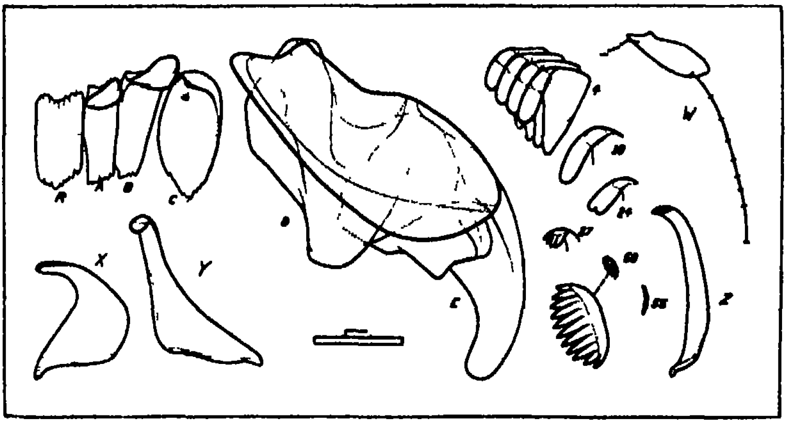

Diagram (W) in upper right hand corner represents positions of highly refractive backs of teeth in right half of a transverse row Both scales represent lengths of 50 microns (05 mm); upper one is for diagram (W), lower one for remainder of drawings. In detailed figures, intervals between R and A, between B and C, and between C and D are increased so as to free edges of teeth. Block of first 4 marginals (foreshortened), and tips of 10th, 24th, 37th, 50th (also shown enlarged), and 55th (cusps omitted) are oriented simply with respect to long axis of ribbon X is an isolated second marginal, Y probably about the 25th, Z probably about the 40th.

In the radula from the smaller shell, fifty-three to fifty-five uncini are present on each side The first twenty-two (Text-fig , X, 4, 10) are unicuspid, the next three to five are bicuspid (24), while the outer teeth increase the number of cusps (37, 50). The innermost marginal (Cf X) consists of a broadly triangular plate, which is thickened at the base and is twisted posteriad and reflected at its upper angle so as to form a spatulate blade The teeth increase in length (i e , height) from the inside out (Cf. Y) and the blades become longer out to about the 12th tooth The outer marginals (37, Z) are ligulate and multicuspid; the outermost (50, 55) have broad, reflected tips with numerous cusplets The other, less complete radula, from which the isolated teeth (X, Y, Z) are taken, is from a larger animal and has 66 marginals on each side

Very little could be made out from the remainder of the animal, but the shape of the muzzle and foot seemed quite similar to that in *Eutrochatella*[3] The tentacles were black in color and triangular, with the width of their bases about half their lengths

This radula is remarkably close to that in *Calybium mouhoti*[4] from Indo-China This is especially interesting because *Calybium massiei*, the type of that genus (and subgenus s s), has parietal lamellae as well as a degenerate, linear, horny operculum, and for this reason was considered by Morlet[5] himself as possibly intermediate between the Helicinidae and the Proserpinidae. The principal differences are the more vestigial rhachidian central, the more elongate and smaller A central, the larger E plate and the greater number of uncini in *Proserpina* On the basis of the radula alone, *Proserpina* could easily be included in the subfamily Vianinae of the Helicinidae, although the more vestigial central does show a slight approach to the condition in the Hydrocenidae.

Gray's classic figure, already cited, is evidently a confused conception taken from a radula mounted ventral side uppermost, but a few salient points are recognisable. In the first place, the A, B, and C centrals (1, 2, 3 of Gray) are certainly multicuspid and of the general shape of those in the subfamily Helicininae. Second, his fourth and fifth "teeth" are refractively-dispersed images of one and the same tooth, which must be a comb-lateral (D plate), such as is also characteristic of the same subfamily Third, the innermost uncinus of his radula is tricuspid while the next ten to eleven appear bicuspid; this is a common arrangement in the genus *Helicina* itself For these reasons, if Gray's figure be even approximately correct, *Ceres* would belong in a different family from *Proserpina*, as it would evidently be derived from a quite different Helicinid stock. However, I strongly suspect that Gray's drawing was made from what he thought to be a juvenile specimen of his *Ceres salleana*, but what was actually an immature individual of some Mexican *Helicina*, probably either *H delicatula* or *H cinctella*

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[3] H B.B., 1926, Proc Acad Nat. Sci Philadelphia, vol 78, p 51, pl. 8, fig 29

[4] H B.B , 1922, pp 59, 64, pl 6, fig. 29

[5] 1892, Jour de Conch., vol 40, p 327

REVIEW OF THE LAND MOLLUSCA OF KOREA

BY HENRY A PILSBRY

- I Introduction
- II List of Korean Land Mollusks with Descriptions of New Species.
- III Narrative of the Second Field Excursion in Korea, by Tokubei Kuroda.
- IV Bibliography

In 1908 and 1909, Mr Y Hirase extended his malacological exploration to Korea The country had not long been under Japanese administration at that time, and conditions were not favorable for a Japanese collector The work had to be restricted to places along the railroads Nevertheless, substantial additions to our knowledge of the fauna were made Several papers were published in Mr Hirase's *Conchological Magazine* describing the discoveries of Mr Tokubei Kuroda, assistant to Mr Hirase, who made the explorations. Further accessions to the fauna are now recorded

A narrative of his second expedition, contributed by Mr Kuroda, forms part of the present paper, pp 470–474, accompanied by an outline map showing the location of all of his collecting stations

A few species collected by Mr R G Mills, and received through the kindness of Mr Frank C Baker, are included

By the scarcity of land operculate snails, Clausiliidæ, and of the *Euhadra* group of helices, the mainland fauna of Korea contrasts strongly with that of Japan, and agrees with what we know of Manchuria.

The mountainous eastern part of the peninsula will probably prove more prolific in mollusks than the less broken and far more accessible southern and western parts Matsushima would doubtless prove highly interesting, and the innumerable islands of the archipelago which are still, except Quelpart and Koje-to, practically unknown, will doubtless sometime turn out many species and races

In O von Moellendorff's census of the land shells of Korea, 1887, twenty-six species are numerated, It is practically certain that two of these, *Helix mackensii* and *H. pallasiana*, do not occur there, and a defective "*Conulus*" was undetermined, leaving twenty-three valid species At present, thanks to the enterprise of Mr Hirase and to Mr. Kuroda's diligence in collecting, some eighty-two species and subspecies are known

II. LIST OF KOREAN LAND MOLLUSKS, WITH DESCRIPTIONS OF NEW SPECIES

Asterisks (*) prefixed to place names indicate material seen by the author. Specimens from places not so marked were identified by Mr. Kuroda.

CYCLOPHORIDÆ

Cyclophorus herklotsi Martens.

*Cheju, Quelpart

Spiropoma japonicum chejuense Pilsbry and Hirase

*Cheju, Quelpart

Cyclotus campanulatus Martens.

Naju (Gottsche); Quelpart (Kuroda). Also Japan.

Cyclotus minutus quelpartensis Pils. and Hir.

*Cheju, Quelpart

Alycaeus kurodae Pils. and Hir.

*Cheju, Quelpart

Alycaeus cyclophoroides Pils. and Hir.

*Fusan

Diplommatina paxillus (Gredler)

*Cheju, Quelpart, *Kojeto, at *Mokpo, a somewhat more robust, reddish variety, and at *Sufun a larger, robust, reddish form with closer striation

Pupinella rufa (Sowb.)

*Fusan, Quelpart (Kuroda)

Cyathopoma micron Pils.

Quelpart (Kuroda, Conchol. Mag. II, p. 27).

POMATIASIDÆ

Omphalotropis japonica Pils.

*Fusan (Kuroda)

TRUNCATELLIDÆ

Truncatella japonica Pils.

*Fusan (Kuroda)

HELICIDÆ

Eulota coreanica (Adams and Reeve)

Helix coreanica A. & R., Zool. Samarang, p. 61, pl. 16, fig. 2

Korean Archipelago "This is the common snail of the islands of the Corean Archipelago, where it is used as an article of food" (A Adams)

Eulota (Euhadra) kurodana n sp Plate XXXIII, figs 3, 4.

*Pukhan-san, near Seoul Types no 99960 ANSP ,from no 1621 Hirase collection, collected by Mr Tokubei Kuroda in whose honor the species is named

The shell is depressed-globose with rather low conic spire and small umbilicus, its width contained 10 to 11 times in the diameter of the shell, moderately solid though not thick; cinnamon buff, fading to buff just below the suture and at the umbilicus, and encircled with a chestnut-brown band above the periphery This band appears narrowly above the suture on the penult whorl The spire is elsewhere pinkish-buff Surface sculptured throughout with irregular striæ of growth and minute incised spiral lines, the first 1¾ whorls nearly smooth Whorls about 5½, moderately convex, the last wide, evenly rounded, convex beneath, slowly and slightly descending in front The aperture is oblique, broadly lunate Peristome thin, expanded and narrowly reflected, brownish, pale at the edge, dilated and whitish towards the columellar insertion, partly covering the umbilicus

Alt 25, diam 31 2 mm Type, fig 3

Alt 22, diam 28 mm

Eulota coreanica (A & R) appears to be a related species, differing in coloration and by the much smaller size

The suprapenpheral band is sometimes very faint, almost absent

Eulota (Euhadra) fragilis n. sp Plate XXXIII, figs. 2, 2a

*Kōm-san near Senchon Type no 99957 ANSP from no 1631 of Mr Hirase's collection, also *Sufun and *Mulkai, all collected by Mr Kuroda

The shell is depressed-globose with conoid spire, narrowly umbilicate, *very thin*, imperfectly translucent, corneous with a faint brownish or faintly yellowish tint. Surface somewhat shining, with delicate sculpture of unequal growth-striæ and minute incised spirals except on the first 1¾ whorls which are nearly smooth The whorls are moderately convex, the last wide, equally rounded, convex at the base, in front it descends very slightly The aperture is oblique, rounded-lunate, the lip forming nearly three-fourths of a circle, expanded and narrowly reflected, faintly brown-tinted, dilated at the columellar insertion, more than half covering the umbilicus. Height 15 7, diam 19 7 mm ; whorls 5½

Related to the preceding species, but smaller and much thinner, with narrower umbilicus and paler in color.

Eulota impatiens (Heude) of China is more depressed, with a wider umbilicus, but seems to belong to the same group

Very beautiful uniform yellowish-corneous examples, slightly more depressed than the type, were taken at Mulkai At Sufun the shells are small, uniform yellowish-corneous or encircled with a reddish-brown band Two measure

Height 15, diam , 19 2 mm , whorls 5¾

Height 12 5, diam , 16 mm , whorls 4¾.

The epiphallus terminates in a long flagellum The dart sac bears a pear-shaped accessory sac with mucous glands inserted at its summit

Eulota (?) verrucosa (Reinh)

Helix verrucosa Reinhardt, Jahrb D. M Ges. 1877, p 322

*Kojeto, Sufun, *Pyong Yang, Chon-ju, Shimbumen near Senchon, Paikma, Chinri-men near Shingishu, Wiju, Antung, China (Kuroda)

It seems strange that this small helicid of eastern Japan should turn up in Korea, but I can see no material difference in the shells

Eulota (?) pumilio Pils and Hir

*Fusan

Systematic position uncertain

Eulota (Acusta) sieboldiana (Pfr)

Seoul and Wiheung (Dr Gottsche) Seoul, Pukhan-san, Suwon, Kaisong, Mulkai, Sufun, Pyong Yang, Chon-ju, Senchon, Shimbumen near Senchon, *Fusan (Kuroda), *Sorai (R G Mills) Also Quelpart Island (Kuroda)

Eulota (Euhadra) koreana (Pfr)

Helix koreana Pfr , Zeitschr f Malak 1850, p 72

Helix hermannseni Pfr., Zeitschr. f Malak. 1852, p. 63; Syst Conchyl Cab *Helix*, p 347, pl 134, figs 5, 6.

Korea (Pfr) Imjin (Dr. Gottsche).

In shape somewhat like *E connivens*, but larger, with the peristome thin, expanded, the basal margin reflected Alt 18, diam. 33 mm.; whorls 5.

A specimen in the Academy of Natural Sciences is labelled as from the Loochoo Islands, probably incorrectly, as Mr. Hirase's collectors did not turn it up there. The species was renamed *Helix herrmannseni* Pfr , under the erroneous impression that *H. koreana* was preoccupied by *H. coreanica*. While the names are similar, they are not identical

Eulota (Euhadra?) purpurascens (Pfr)

Helix purpurascens Pfr , Proc Zool Soc 1853, p 126, Reeve Conch Icon *Helix*, pl 185, fig 1281

Korea (Cuming coll) This handsome and interesting species has not been rediscovered The indefinite record must be considered doubtful, as the source of Cuming's specimen is unknown.

Eulota (Euhadra) orientalis (Adams and Reeve) Plate XXXIII, fig 1

Helix orientalis Adams & Reeve, Zool 'Samarang' 1848, p 61, pl. 16, fig 4 *Helix germanus* Reeve, Conch Icon , *Helix*, pl 74, fig 385, Pfeiffer, Monogr III, p 222, Syst. Conchyl. Cab , *Helix*, p 383, pl 142, figs. 1 2

*Cheju, Quelpart (Kuroda)

Specimens are figured to show the exact form found, as former locality records for the species are conflicting The original locality, "Borneo" was certainly wrong Arthur Adams (Ann Mag N H 4th Ser , I, p 461) reported it from Nagasaki, Mososeki and Tsushima, but he evidently confused forms of *Euhadra luhuana* with the species he had described many years before Specimens not exactly similar but seeming to be conspecific, in our collection, received from a dealer, are labelled "Chekiang, China" and "Japan " The latter locality appears very dubious Perhaps the Chekiang specimen is an allied species *H orientalis* was not mentioned in von Moellendorff's or Heude's papers on Chinese land mollusks It appears very closely allied to the Chinese *E* (*Euhadra*) *cecillei* Philippi, which I have not seen, and which the authors just mentioned did not possess Evidently *E* (*Euhadra*) *moreletiana* Heude is also related

Eulota luhuana tsushimana (Mlldff)

Quelpart (Kuroda)

A Adams reported *E luhuana* (Sowb) from Dagalet Island (Matsushima) It appears likely that the specimens collected by Kuroda and Adams were introduced in those islands by commerce. I have not seen specimens

Eulota (Euhadra) callizona minor Gude

Quelpart (Kuroda, Conchol Mag II, p 28)

Probably introduced by commerce from Nagato province I have not seen Quelpart specimens

Eulota (Ægista) tenuissima Pils. and Hir

*Fusan

Eulota (Ægista) chosenica n sp Plate XXXIV, fig 1

*Sufun Types no 99956 ANSP from no 1627 of Mr. Hirase's collection Mulkai (Kuroda)

The shell is depressed. subdiscoidal, with a low conoid spire and broadly open umbilicus, its width 37 per cent of the diameter; rather solid, uniform brown, dull and nearly lusterless. Upper surface densely, very finely striate, the striæ thread-like, mainly cuticular; lower surface marked with fine, inconspicuous, growth-lines with an under sculpture of minute, very close spiral striæ; within the margin of the umbilicus the striæ bear minute cuticular scales Whorls 7¼, moderately convex, very slowly increasing, the last slightly descending in front, *rather acutely angular at the periphery*, very convex around the umbilicus. The aperture is small, oblique, rounded-lunate Peristome flesh-colored, the upper margin expanded, outer and basal margins reflected, decidedly thickened within Parietal callus very thin Height 6 5, diam 13 5 mm, width of aperture including peristome 5.2, alt 5 mm

A very openly umbilicate, many-whorled species, with strongly angular periphery It differs from other Korean Ægistas by the thickening or callous rim within the peristome, as in most Japanese and Chinese species The specimens seen vary in size from 12 3 to 14 mm diameter

Eulota (Ægista) gottschei (Mlldff) Plate XXXIV, figs 4, 6, 7

Helix (Aegista) gottschei Moellendorff, Jahrb D M Ges. XIV, 1887, p 14, pl. 2, f 3*a–c*

Eulota (Aegista) mimula peninsularis Pils. and Hir , Conchological Magazine III, Jan , 1909, p 10

Seoul (Dr Gottsche) In various forms at *Mokpo, *Fusan, *Chonpan-san near Kunsan, and *Pukhan-san north of Seoul (Kuroda)

"Shell openly and deeply umbilicate, depressed-conoid, microscopically lineate spirally, and especially obliquely lightly striate, sculptured with membranous riblets generally interrupted and freely deciduous The 6½ to 7 whorls are a little convex, the last whorl obtusely angular at periphery and around the umbilicus, very shortly descending in front Aperture is diagonal, lunate-rotund, the peristome thin, narrowly expanded, a little reflected, the margins converging Height 6 5, greater diameter 11, lesser 9 5 mm" (*Mlldff*)

I am now of the opinion that the form I called *E m peninsularis* is a variety or possibly subspecies It differs by having the "membranous riblets" interrupted into scales, and the border of the umbilicus, while rather sharply curved, is not what I would call "obtusely angular "

In various forms this species has been found from Mokpo and Fusan in the south to Mt Pukhan near Seoul

In most localities the cuticular processes are in the form of longer or shorter adnate threads in the peripheral region, interrupted into short scales above and below it (fig 7) The form from Pukhan-san is largest, diam 11 8 mm, with the scale-sculpture most strongly developed in specimens not quite mature (Plate XXXIV, fig 6)

The Chinese *Eulota* (*Aegista*) *radulella* (Heude) is more openly umbilicate with the spiral lines nearly effaced *E* (*Aegista*) *scitula* Pils & Hir has a decidedly narrower umbilicus Both appear closely related to *E gottschei* The Japanese *E mimula* Gude lacks spiral lines, and is certainly distinct

Eulota gottschei fusanica n subsp Plate XXXIV, fig 5

The form from Fusan has very fine cuticular processes which are deciduous in fully adult shells, and the size is uniformly small: height 4 9, diam 7 7 mm, 6 whorls

Eulota (Ægista) chejuensis Pils. and Hir

*Cheju, Quelpart

Eulota (Ægista) proxima Pils. and Hir

*Koje-to

Eulota (Ægista) pyramidata n sp Plate XXXIV, fig 2

*Nunhan-san, near Chon-ju Type and 2 paratypes no 99953 ANSP from no. 1628*a* of Mr Hirase's museum Also Shim-bumen near Senchon and at Antung, Manchuria Collected by T. Kuroda

The shell is pyramidal, openly umbilicate, the width of the umbilicus about 40 per cent of the diameter, thin but moderately strong, of a dull brown color The surface is lusterless, and bears rather widely spaced cuticular, thread-like processes along the growth-striæ in places, and towards the suture and umbilicus short scale-like processes; all being more or less deciduous. Within the umbilicus it is finely granulose The spire is conoidal with very slightly convex outlines. Whorls nearly 7½, moderately convex, very slowly widening, the last whorl descends very slightly in front and is *rather acutely angular at the periphery*, the angle weakening somewhat near the outer lip It is very convex but not angular around the umbilicus. The aperture is small, rounded, the peristome forming about three-fourths of a circle, brownish, thin, narrowly expanded, the basal margin narrowly reflected.

Height 6 3, diam 9.7 mm, width of aperture 3 3 mm.

In this species the umbilicus is more widely open than in *E. chejuensis*, *E proxima* or *E gottschei* in its several forms. It differs further from *E gottschei* (Mlldff) by wanting an angle around the umbilicus and by having cuticular scales, not riblets It appears that *P gottschei* of the southern half of the peninsula is replaced in northern Korea by *P pyramidata*

Eulota pyramidata hebes n subsp Plate XXXIV, fig 3.

*Pyong Yang Type and paratypes 99954 ANSP, collected by T Kuroda

Related to *E pyramidata*, but much more depressed, less angular, the periphery being blunt and rather rounded, umbilicus a little wider Dull brown, with close scaly sculpture The peristome is thin, narrowly expanded

Height 6 3, diam 11 5 mm

Eulota (?) gradata (Mlldff)

Hatong and Thosan in south Korea (Dr. Gottsche)

A conoidal snail with subacutely angular periphery, perforate, corneous-brown, covered with very short, very close hairs. There are six very convex whorls The peristome is thin, slightly expanded, the columellar margin dilated and reflected Height 6, diam 6¼ mm

The generic position of this snail is uncertain

Eulota (Ægista ?) lasia Pilsbry

*Fusan (Kuroda).

Eulota (Plectotropis) quelpartensis Pils and Hir Plate XXXIII, fig 6

Eulota (Plectotropis) vulgivaga quelpartensis Pilsbry & Hirase, The Conchol Mag II, 1908, p 61

Cheju, Quelpart Island

The clear buff or creamy color, copious development of short cuticular "scales" on both upper and basal surfaces, much as in *E trochula* of Tsushima, and the shorter, more delicate peripheral processes, all differentiate this form from the Japanese *E vulgivaga*, of which I have seen long series from over a dozen localities. I think *quelpartensis* should stand as a separate species. The type (central figure) and two paratypes are figured.

A Adams[1] reported "*H mackensii* Val " from Cone Island (near and east of Port Hamilton) That species, the largest *Plectotropis*, is a well known Ryukyu snail, not likely to occur in the Korean archipelago Probably it was the present form or something closely related which Adams found

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[1] Ann. Mag Nat. Hist. (4) I, 1868, p 460

Eulota (Plectotropis) ciliosa (Pfr)

Port Hamilton (A. Adams, 1868) Originally described from the "north of China (Mr Fortune)" but later naturalists have not found it Dr Adams did not mention which of the three islands enclosing Port Hamilton supplied this snail

Eulota (Trishoplita) ottoi n sp Plate XXXIII, figs *5, 5a, 5b*

*Fusan, type loc , *Cheju, Quelpart (Kuroda)

The shell has much the appearance of *Trishoplita dacostae awajiensis* Pils It is thin, somewhat depressed with conoidal spire, umbilicate, the width of umbilicus contained about 6 times in the diameter, light brown, with lighter and darker obliquely radial streaks on the spire, surface rather dull, with only faint growth lines, but closely sculptured with spiral incised lines The whorls are moderately convex and increase slowly, the last whorl descending a little to the aperture, indistinctly angular at the periphery. The aperture is oval-lunate, with narrowly expanded white peristome, dilated at the columellar insertion

Height 5 6, diam 8 mm , 5½ whorls Type

Height 6 2, diam 8 8 mm

It differs in sculpture from *Trishoplita dacostæ awajiensis*, but was at first mistaken for that species and so recorded in The Conchological Magazine, II, 1908, p 60, and Proc. Acad Nat. Sci. Phila 1908, p 455

At Cheju, Quelpart Island, the size is smaller, diameter about 7 mm

Named for Otto von Moellendorff, who published a useful paper on the Korean fauna in 1887.

CAMAENIDAE

Ganesella virgo n sp Plate XXXV, figs. 7, 7a

The shell is globose-conic, narrowly umbilicate, the width of umbilicus contained about eight times in the diameter of the shell, thin but not fragile, whitish with a faint yellowish-gray tint, somewhat translucent The shining surface has a microscopic sculpture of fine growth-striæ and minute incised spiral lines, the first whorl smooth. The spire is conoidal with very slightly convex outlines. Whorls 5¾, at first slowly enlarging, the penult and last whorls more rapidly widening, the last whorl evenly convex, its last third slowly descending Aperture quite oblique, rounded-truncate, the peristome white, expanded, strengthened by a white callous rib within, the columellar margin a little straightened, reflected, dilated nearly over the umbilicus

Alt 12 5, diam 13 7 mm Type

Alt. 12 3, diam 13 8 mm.

*Wichu (Uiju) Type and 2 paratypes no 99965 ANSP, from no 1633 of Hirase's coll Also Chinrimen near Shingishu (Kuroda).

This species has a somewhat bullet-like contour and the pale color of the Japanese species It is the first *Ganesella* known from Korea The snail described as *Helix* (*Satsuma*) *gradata* Mlldff probably does not belong to this genus

Chloritis (Chosenelix) problematica n sp Plate XXXV, figs 9, 9a

*Pukhan-san, near Seoul Type and three paratypes no 99969 ANSP, from no 1622 of Mr Hirase's collection Also reported from Mulkai and Sufun by Mr Kuroda.

The shell is depressed-globose, very narrowly, partly covered umbilicate, corneous, translucent, thin and fragile, having a somewhat silky sheen Growth-striæ are only very weakly marked, and with a lens weak impressed spiral lines are seen Under the compound microscope, the spaces between these lines are seen to be sculptured with extremely fine, irregularly curved thread-like lines having the general direction of growth-lines There is also, in places, some slight appearance of regularly arranged papillæ The spire is low-conoidal The apical whorl is irregularly rugose microscopically Whorls 5, moderately convex, the last much wider, well rounded peripherally and basally. The aperture is rounded-lunate, slightly oblique Peristome unexpanded, thin and simple except near the columellar insertion where it is triangularly dilated, half or more than half covering the umbilicus

Height 12 8, diam 17 mm.

This is a very peculiar snail, quite unlike anything I have seen from Japan or China, and I make it type of the new subgenus *Chosenelix*, subordinated for the present to *Chloritis*, though its generic position is quite uncertain

ACHATINIDAE

Descriptions and figures of the species of *Opeas* are to be found in Manual of Conchology, XVIII

Opeas javanicum (Reeve).

Seoul (Dr Gottsche). Recorded by von Moellendorff as *Stenogyra* (*Opeas*) *striatissima* Gredler, which I think is identical with the widely distributed *O javanicum*.

Opeas clavulinum kyotoense Pils.

Quelpart Island *Chon-pan-san near Kunsan; *Hazan, near Fusan and at *Fusan (Kuroda)

Opeas heudei Pils.

Mokpo, Quelpart (Kuroda), identified by Kuroda I have not seen these specimens. Those I have seen from *Chanam, near Kunsan, are clearly this Chinese species

CLAUSILIIDAE

Clausilia (Euphaedusa) aculus coreana Mlldff

Pass between Muan and Mokpo (Dr Gottsche)

This form is described as rather slender, very finely striate, glossy, reddish-brown. Aperture vertical, rather narrow, piriform, with the sinulus produced well upward. Peristome strongly thickened within, though less than in var *labio* Gredler The hump-like wave behind the outer lip is weakly developed Some specimens have several palatal plicæ A mutation *albina* is represented by one example Length 12 5 to 14 5 mm

I have not seen it

Clausilia (Euphaedusa) aculus mokpoensis Pils. and Hir

*Mokpo Differs from the preceding by its thin peristome, etc. Dr A Adams reported *C aculus* from Fusan, but what he had may have been *C fusaniana*

Clausilia (Euphaedusa) gottschei Mlldff

Mokpo (Dr Gottsche).

The shape of the lunella and palatal plicæ agrees with *C tau*, but the latter is not so long, and the subcolumellar lamella emerges, and sometimes continues to the margin In the size of the superior lamella it is intermediate between *tau* and *aculus* The inferior lamella agrees better with *tau*, but is more strongly coiled spirally The shape of the aperture and the strongly lipped peristome, and especially the united superior and spiral lamellæ are like *aculus*. The striation of the shell is finer and less distinct than in either of the allied species Length 12–14½, diam 3–3½ mm ; whorls 10

I have not seen this species, which is evidently related to the next

Clausilia (Euphaedusa) fusaniana Pils. and Hir

*Fusan; Koje-to; Cheju, Woné and Mt Hanra, Quelpart The variations of this species have been discussed in The Conchological Magazine

Clausilia (Euphaedusa) tau Boettger Jahrb D M Ges V, 1878, p 46, pl 3, fig. 2 Pilsbry, Proc A. N S Phila 1902, p 527, pl 28, figs. 36, 37, 43, 44, 45

Naju, in southwestern Korea (Dr Gottsche)

Clausilia (Euphaedusa) belcheri Pfr Monogr Hel. Viv III, p 591 Kuester, Conchol. Cab, Clausilia, p 220, pl 24, figs 18-20

Korean Archipelago (Sir Edw. Belcher)

"Shell subrimate, fusiform-subulate, rather solid, smooth, pellucid, buff-corneous variegated with white Spire very slender, the apex acute Whorls 13, convex, the last rather swollen at the base Aperture piriform, lamellæ of moderate size, approaching one another, no lunella, two parallel palatal plicæ parallel to the suture, the upper one longer, the other short Subcolumellar lamella inconspicuous Peristome continuous, shortly free, thickened within, narrowly reflexed Length 12 to 13, diam 3 mm.; aperture 3 mm long"

This species, which I have not seen, is shorter than *C fusaniana*, with more numerous whorls, according to the original description, translated above

Clausilia (Euphaedusa) claviformis Pfr Monogr Hel. Viv III, p 591

Korean Archipelago (Sir Edw Belcher)

Shell slightly rimate, somewhat club-shaped, thin, smooth, glossy, buff-corneous, variegated with white Spire turrite, the apex acute Whorls 9, a little convex, the last rounded at the base Aperture elliptic-piriform, lamellæ delicate, the inferior lamella deep within, nearly transverse, no lunella Two palatal plicæ, the upper one rather short, parallel to the suture, the lower one very short Subcolumellar lamella extending to the margin of the lip. Peristome continuous, scarcely free, thin, narrowly expanded. Length 12, diam 3 5, aperture 3 mm long

This species has not been figured and I have not seen it It seems to differ from most related forms by its emerging subcolumellar lamella The original description is translated.

STREPTAXIDAE

Gulella (Sinoennea) cava (Pils. and Hir)

Ennea cava Pilsby and Hirase, the Conch. Mag II, 1908, p 61, pl 4, figs 8, 9

*Cheju, Quelpart Island

It was recorded by Kuroda as *Ennea iwakawa* var. (Conchol. Mag II, p 27)

ZONITIDÆ

Petalochlamys subrejecta Pils. and Hir

P subrejecta Pilsbry and Hirase, Proc. A.N S Phila., 1908, p. 595, text-fig 2.

*Fusan Also occurs at *Sasuna, Tsushima, the type locality.

Petalochlamys subrejecta bella new subsp

*Pukhan-san, near Seoul Type and four paratypes no. 99935 ANSP, from no 1624 of Mr Hirase's collection Also taken at Pyong Yang, Sufun, Nunhan-san near Chonju and Paikma (Kuroda)

The shell is a rich transparent chestnut color above, fading to corneous at the apex and around the umbilicus. The microscopic spiral striation is much more deeply cut

In about 17 years, since these shells were first examined, the chestnut color has almost faded away

Petalochlamys quelpartensis Pils. and Hir

Macrochlamys quelpartensis P & H, The Conchological Magazine II, Nov 1908, p 63 Hirase, *l c*, p 76, pl 22, figs. 18, 19

*Cheju (type loc) and Chongkori, Quelpart I.

This species has fewer whorls in a greater diameter than *P. subrejecta*, it is less depressed and the spire slightly narrower

Macrochlamys hypostilbe Pils and Hir The Conch Mag II, p 76, pl 5, fig 10 — Hirase, *l c* p 76, pl 22, figs. 15, 16, 17

*Fusan

Macrochlamys fusanus Hirase The Conch. Mag II, 1908, p 56, pl 21, f 4–7

Fusan

A small species, height 3, diam 5 5 mm Only four collected

Microcystina lampra Pils. and Hir

*Hanra-san near Cheju, Quelpart

This is probably what Mr Kuroda reported as *M vaga* (Conch Mag II, p 27)

Microcystina sinapidium (Reinh)

*Seoul (Kuroda).

Pseudohyalina minuscula (Binney)

Seoul, Suwon, Kaisong, Sufun, Pyong Yang, Chonju, Senchon, Shimbu-men and Kōm-san near Senchon, Paikma, Chinri-men near Shingishu; Wiju, and Antung, China (Kuroda).

Kaliella multivolvis Pilsbry

Quelpart (Kuroda Conchol Mag II, p 27)

Kaliella crenulata Gude.

*Cheju, Quelpart.

Kaliella fusaniana Pils. and Hir The Conch Mag II, p 12, pl. 5, fig. 11 Hirase, *l. c.* p. 76, pl. 22, fig. 29

*Fusan.

K fusamana has about forty to forty-four vertical striae in 1 mm , on the base excessively faint traces of spirals only. The form is more depressed and more angular than *K. coreana*, with fewer whorls.

Kaliella obesiconus Pils. & Hir Plate XXXV, fig. 2 The Conch Mag 11, p. 12, pl. 5, fig 12. Hirase, *l c.* p 76, pl 22, fig. 30

*Koje-to

Whorls fewer than in *K coreana*, and the aperture is much wider

Kaliella kunsanica new species. Plate XXXV, fig 3.

*Kunsan Type and paratype no 141914 ANSP, collected by T Kuroda, 1910

The shell is perforate, conic, the spire with slightly convex outlines and very obtuse apex, the whorls are strongly convex, the last being well rounded peripherally Light brown, somewhat glossy, microscopically striate vertically The aperture is lunate, outer and basal margins of the peristome are thin, the columellar margin expanded, brown-calloused within

Height 2 1 mm , diam 2 4 mm , 5½ whorls. This form appears related to *K. obesiconus*, but the aperture is decidedly narrower

Kaliella coreana (Mlldff) Plate XXXV, figs. 6, 8.

Conulus ? coreanus Mlldff , Jahrb XIV, p 10, pl 2, f 1*a–c*

*Seoul (Dr Gottsche, T. Kuroda), *Sufun, also reported from Suwon, Pyong Yang, Chonju, Shim-bu-men and Kōm-san, near Senchon (Kuroda)

Shell half-covered perforate, globose-conic, minutely striatulate, rather glossy, pellucid, tawny Spire convexly conic, the apex obtuse Whorls 6½, convex, the last not descending Aperture lunar, a little oblique, peristome unexpanded, acute, the columellar margin reflexed at the perforation Alt 2 5, diam 2 5 mm

To the original illustration, fig 8, I add a view of a topotype, fig 6 It measures height 2 5 mm , diam 2 75 mm , 6½ whorls. Under a high power lens excessively fine vertical striæ are seen, about 100 in 1 mm on the face of the last whorl. They are shallow, much as in *Euconulus*. There are no spirals on the upper surface, but the base has fine impressed spiral lines, about 52 in one mm

The outlines of the spire are more convex than in related Korean species The surface has a rather silky luster rather than a bright gloss

Specimens from Sufun are more glossy; one measures: height 2 6 mm , diam 2 8 mm

Kaliella serica new species Plate XXXV, figs. 4, 5, 5a.

*Pyong-Yang, type and 5 paratypes, Paikma; *Chinnimen near Shingishu; and *Antung, Manchuria Type 99933 ANSP, collected by T Kuroda.

The shell is perforate, conic, the spire with slightly convex lateral outlines, the whorls rather strongly convex, the last rounded peripherally Surface with a silky luster, due to vertical microscopic striation, about as fine as in *K coreana* The silky appearance extends below the periphery forming a zone on the base, below which the surface is glossy. Aperture lunate, narrow, the outer and basal margins of the peristome thin, columellar margin reflected, white-calloused within

Height 2 75 mm , diam 3 1 mm , 6½ whorls Antung

Height 2 6 mm , diam 3 1 mm , 6½ whorls Type.

This form, while closely related to *K coreana* differs by its relatively lower spire with less convex outlines Immature shells are relatively lower than the adult form.

PHILOMYCIDÆ

A Adams, in his "Travels of a Naturalist in Japan and Manchuria" (London, 1870), p 178, reported finding a slug "with the mantle covering the whole of its back" on Dagelet Island (Matsushima)

ENDODONTIDAE

Gonyodiscus costulata (Mlldff)

Patula costulata Mlldff , Jahrb D M Ges. XIV, p 11, pl 2, figs. 2*a–d*.

Takol, northern Korea (Dr Gottsche)

This species is said to be nearly related to *G pauper*, but more sharply carinate and having a second carina around the umbilicus Height 2 mm , diam 4 mm It was based upon one specimen not fully adult

Gonyodiscus elatior (A Adams)

Patula elatior A. Ad , Ann Mag N H (4), I, 1868, p 466

Matsushima, or Dagelet Island (A Adams)

Von Moellendorff reported this species, with a good deal of doubt, from the mainland of Korea

Punctum amblygona conoideum (Mlldff)

Patula amblygona Reinhardt var *conoidea* Mlldff , Jahrb XIV, p 11

Hatong (Dr Gottsche) "Alt 2, diam 2½ mm. Differs from the type by its slightly higher shape " The typical *amblygona* is Japanese. Von Moellendorff did not actually compare specimens.

Punctum rota Pils. and Hir Proc. A N S Phila. 1904, p 637

*Kojeto (Kuroda) Known from Japan, where it appears to have a wide distribution

Succinea horticola koreana new subsp Plate XXXV, fig 10

Pyong Yang, *Paikma, *Chinrimen near Shingishu, and Wichu in the northwestern angle of Korea (Kuroda); also across the border at *Antung Type and paratype no 99947 ANSP, from Chinrimen

The shell is very thin, ovate, very pale corneous buff, of three strongly convex whorls Surface shining, with rather coarse, unequal wrinkles, chiefly on the last part of the last whorl, under the microscope the surface is seen to be minutely roughened in places by fine spaced granules, and there are also traces of spiral impressions The aperture is rather broadly ovate, about 72 per cent of the length

Length 8, diam. 5, length of aperture 5 8 mm

It is a thinner, more fragile shell than Japanese *S horticola*, but appears very close to that species

I at first thought that this might be *S alpestris* Mlldff ,[3] but in the same length that shell has four whorls, and moreover, has the appearance of the European *S oblonga* Smaller examples of *S alpestris* from Pekin before me show it to be quite distinct *S h koreana* is decidedly thinner than *S. rubella*, *S setchuanensis* and *S magnaciana* of Heude, which we have received from Heude

Succinea hirasei Pils. Plate XXXV, figs. 11, 12, 13

Succinea hirasei Pilsbry, Proc A N S Phila. 1901, p 348 (Tsuchiura, Hitachi, Japan)

? *Succinea* cf *pfeifferi* Rossm , Moellendorff, Jahrb D. M. Ges. XIV, 1887, p. 20 (Seoul)

Sorai (R G Mills, 1915)

While not exactly like the Japanese form, it appears too close for distinction. The Chinese *S arundinetorum* Heude, from the Yangtse river, is a more opaque and slightly less elongate form The largest specimen figured measures 1.5 mm long.

There can be very little doubt that it was this species which Moellendorff referred to as comparable to *S pfeifferi* of Europe

PUPILLIDAE

Ena coreana Pils. and Hir

*Fusan Also reported by Kuroda from Mokpo and from Quelpart Island (Conchol. Mag. II, p 28)

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[3] Jahrb. D M. Ges. II, p. 219.

Pupilla heudeana (Mlldff.) Man. Conch. XXVI, p. 200, pl. 22, f. 1–5

Quelpart Island *Fusan, Mokpo, Seoul, Suwon; Sufun, Pyong Yang, Chonju, Paikma, Chinrimen near Shingishu and Uiju (Kuroda) *Seoul (Gottsche)

Gastrocopta armigerella (Reinh.) Man. Conch. XXIV, p. 107

Seoul and Hatong (Dr Gottsche).

Seoul, Suwon, Kaisong, Sufun, Pyong Yang, Chon-ju, Senchon; Shimbumen near Senchon, Paikma, Chinrimen near Shingishu; Uiju and Antung (Kuroda)

Gastrocopta hirasei Pils. Man. Conch. XXIV, 1916, p. 110

*Kojeto, one specimen with the following species.

Gastrocopta coreana Pils. Man. Conch. XXIV, p. 109, pl. 21, f. 2–4

*Kojeto (Kuroda)

Vertigo japonica coreana Pils. Man. Conch. XXV, p. 156, pl. 14, f. 4

Quelpart Island, *Kojeto, *Fusan, *Chon-pan-san, near Kunsan, *Sufun and *Chon-ju (Kuroda)

Pyramidula micra new species Plate XXXV fig. 1 1*a* 1*b*

*Bay of Ulsan (northeast of Fusan) Type and 8 other specimens no. 49557 ANSP, from no. 1530*a* of Mr Hirase's collection

The shell is low-conoidal, rather narrowly umbilicate, the width of umbilicus contained five times in the diameter of the shell, pale yellow or pale brown tinted, thin Spire low-conic, the apex obtuse. Whorls about 3½, the first 1½ glossy, very faintly marked with spiral striæ, following whorls with sculpture of fine growth-lines and rather widely spaced stronger striæ, in some places nearly regular, elsewhere unevenly spaced or subobsolete In the intervals on the upper surface there are traces of minute spiral striæ. The base is marked with close, fine spiral striæ The last whorl is strongly convex and well rounded at the periphery and base. Aperture much larger than the umbilicus, somewhat oblique, rounded, the thin peristome forming three-fourths of a circle.

Alt. 1.4, diam. 2 mm.

This species is very similar to the Chinese *Pyramidula orphana* (Heude), described as a *Helix*, but that species is decidedly larger It may possibly be a *Punctum*, but it is not like any of the known Japanese species. The generic position of this and Heude's species remains uncertain for the present.

STROBILOPSIDAE

Strobilops hirasei Pils.

*Cheju, Quelpart.

Strobilops coreana Pilsbry

*Pyong Yang (Kuroda)

VALLONIIDÆ

Vallonia tenera Reinh

*Ulsan (a bay northeast of Fusan) Seoul, Suwon; Kaisong, Sufun, Pyong Yang, Chon-ju, Senchon, Shimbu-men near Senchon, Paikma, Chin-ri-men near Shingishu, Uiju (Kuroda)

COCHLICOPIDÆ

Cochlicopa lubrica (Müll)

*Simbumen, near Senchon, Pyong Yang, Kaisong, Seoul (Kuroda) A Adams reported a *Zua* (= *Cochlicopa*) from Matsushima (Travels of a Naturalist in Japan and Manchuria, p 178)

CARYCHIIDÆ

Carychium pessimum Pilsbry

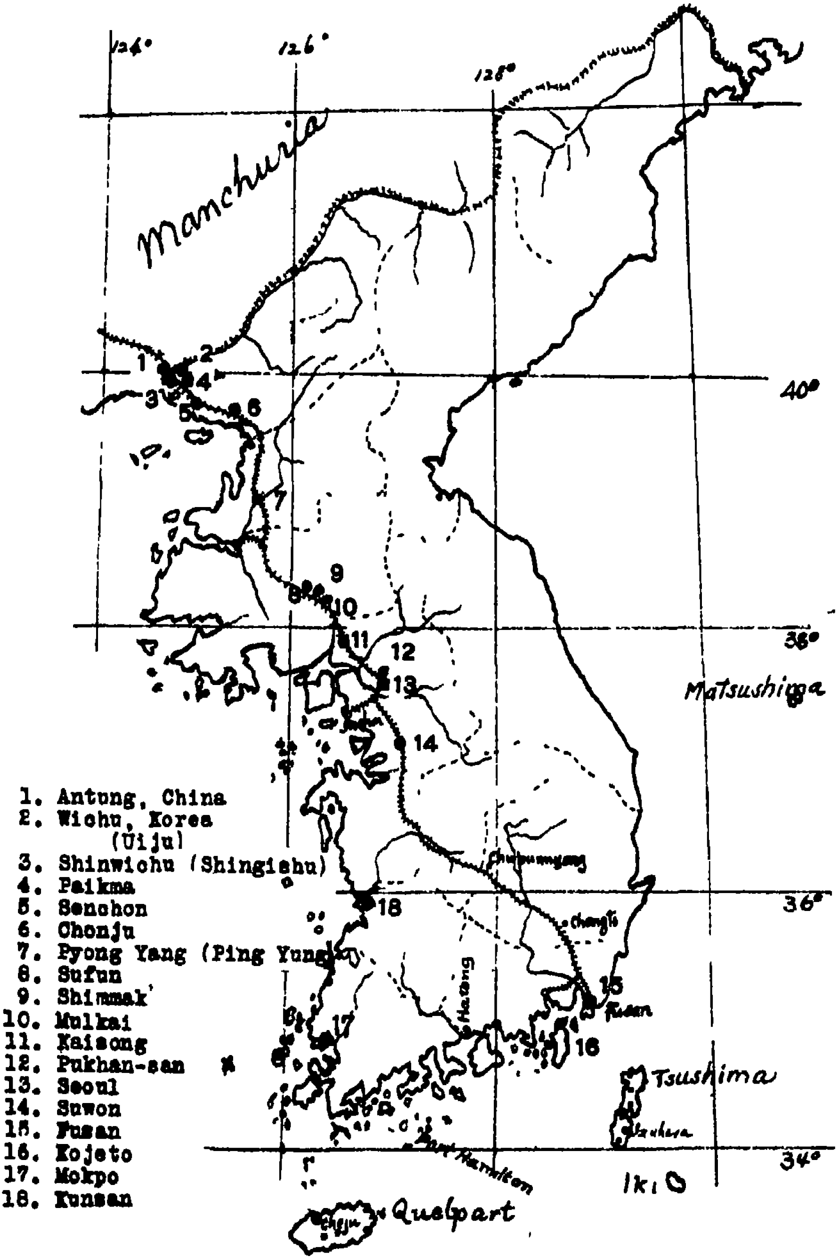
*Pyong Yang (Kuroda) Also found in Japan and the Ryukyu Islands

Carychium noduliferum Reinh

Quelpart (Kuroda Conchol Mag II, p 27)

III NARRATIVE OF THE SECOND FIELD EXCURSION IN KOREA BY TOKUBEI KURODA

Having been asked by Mr Hirase to make explorations and collect land shells in Korea, I set out on the journey. On June 7th, 1909, I left Kyoto and started for Seoul I had intended to stay at Seoul as the headquarters of my field work in Korea for some days, in order to explore its suburbs and vicinity, and also to make trips to other quarters in every direction On the 12th I safely arrived at the city by train. As the rioters had not yet been suppressed, we travelers could by no means feel at ease. I had visited Hon S Omon, Governor of Kyoto Prefecture, who had given Mr. Hirase profound sympathy with the latter's undertakings, and asked him for a recommendation, to which the governor had willingly given consent On my arrival at Seoul, I went directly to the Residency-General, and showing the recommendation, I applied for their protection for my field-work and myself I was allowed to work at pleasure under government protection, so to speak, as long as I stayed in Korea.



Outline Map of Korea Showing Mr T Kuroda's Collecting Stations

I explored the city and its suburbs, and also Mt Puk-han in the vicinity I spent 25 days here Then I went to Pyong Yang (or Ping Yang) where I stayed for a week and made explorations in the neighborhood Next I went farther north by rail, and from July 14th to 24th I stayed at Shingishu (New Wiju), nine miles southwest of Wichu (or Wiju) on the northwestern boundary, and explored thereabouts While staying here, I sometimes proceeded as far as Wichu and Antung, and occasionally went back as far as Paikma, and made explorations in the neighborhood Then I began to retreat I explored Senchon and vicinity I climbed a rocky mountain by the name of Kōm-san, about six miles away. On the 31st I arrived at Chonju and collected shells in the vicinity I stayed here till Aug 5th Mt Nunhan-san also was explored Then proceeding to the south by train, I passed Pyong Yang, and got out at Shimmak station. I spent five days here, exploring Sufun, five miles to the north, and Mul-kai, six miles to the south Then I went to Kaisong and stayed for four days, making explorations in the neighborhood.

On the 16th of August, I returned to the headquarters in Seoul I made a trip to Suwon and spent a day there

My field work in the northern part of Korea was finished

All the species I could collect at my best are given in the following list [This has been incorporated in the preceding catalogue—H A P]

Though I traveled quite a long distance, the species I could collect were very few, and they had especially little variation As regards small species, almost no different ones were to be found anywhere

Compared with a collection made in an equal area of land in Japan, this field work was very unfruitful It seemed to me that such poor results were due to reckless deforestation, which had left few mountains and valleys covered with beautiful green trees, to the scant rainfall except in the rainy season, and to the low temperature in winter

I wished this land had been an island, because islands are richer in various species than such a land connected with the continent

To make the matter worse, the rainy season began on July 6th, and it went on raining until Aug. 2nd Torrents of rain, and floods prevented me from working in accordance with my first plan, and as regards other matters I felt a great deal of inconvenience

Leaving the headquarters behind again, I started for Kunsan that I might learn the relation between the species in the neighborhood of Mokpo, which I had visited last year, and those of the northern part which I had this time collected

I went to Inchon (or Chemulpo) at first I had first intended to make explorations here, but as I thought that the species I could collect here would be the same as I had collected in the north, I took a boat and hurried to Kunsan in the midway to Mokpo I explored two places in the vicinity, and the results were as follows:

Eulota sieboldiana Pfr Kunsan and Chan-am
Eulota verrucosa Reinh Chan-am-ri
Eulota gottschei Mlldff. var Chompan-san
Vallonia tenera Reinh Chan-am and Kunsan
Kaliella sp (1634) Chompan-san; Chan-am-ri and Kunsan
Pseudohyalina minuscula Binn. Chompan–san and Chan-am
Microcystina sinapidium Reinh Kunsan and Chompan-san
Cochlicopa lubrica Müll Chan-am (Chan-am-ri).
Opeas clavulinum P & M var *kyotoense* Pils Chompan-san
Opeas pyrgula (A Adams) S & B Chan-am and Kunsan
Opeas heudei Pils Chan-am-ri
Pupilla heudeana Mlldff (*cryptodon* Heude) Chan-am.
Vertigo japonica P & H Chompan-san, Chan-am-ri
Gastrocopta armigerella Reinh Chan-am-ri

Thence I should have proceeded by land as far as Chupunnyong and Chongto, where I had intended to make explorations, but various accidents and some unavoidable circumstances encountered in succession prevented me from continuing the first plan and obliged me to give it up halfway Such being the case, I safely arrived in Kyoto on September 4th

A journey in Korea is very different from one in my country. Things are much dearer We have much to spend and little to get, as is stated above

The difficulty of communication and the rampancy of anti-Japanese rioters were the two great obstacles, and made me hesitate to penetrate into interior districts, or explore deep mountains and dark valleys I cannot help thinking that the expedition was far too hasty, that is, it was too early yet to make such an expedition.

I do not at all believe that what I have done completes the knowledge of the Korean land shells Yet I am well convinced that I have slightly contributed to the knowledge as to how species are distributed in northern Korea, and how those in northern China, Korea, and Japan are related to one another

I hope some more useful and interesting future facts will be found in the same districts that I explored I expect that some earnest collector will come forth and gratify our expectation by making great discoveries

In case I have time to spare in the near future, I will visit the Korean archipelago and try all I can to find some interesting species and to add some new names to the list of Korean shells

In concluding this short communication it may be noted that in spite of my greatest care and attention, especially to *Clausilia* during my journey, I failed to find any species either of *Clausilia* or *Cyclophoridæ* (except a *Diplommatina*), though they are to be found almost everywhere in Japan and the southern or the middle part of China

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EXPLANATION OF PLATES XXXIII–XXXV

PLATE XXXIII —Fig 1 —*Eulota orientalis* (A. & R.) Cheju 95728
Figs. 2, 2*a*.—*Eulota fragilis*, n sp. Type 99958
Fig 3 —*Eulota kurodana*, n sp Type. 99960
Figs 4 —*Eulota kurodana*, bandless form. 99960.
Figs. 5, 5*a*, 5*b* —*Eulota ottoi*, n. sp. Type 95817
Fig 6 —*Eulota quelpartensis* Pils. & Hir Type, central figure, and two paratypes. 95729

Figs 5, 5*a*, 5*b* × 2, fig 2*a* slightly enlarged, the others natural size.

PLATE XXXIV —Fig 1 —*Eulota chosenica* n sp Type 99956
Fig 2 —*Eulota pyramidata* n sp Type 99953
Fig 3 —*Eulota pyramidata hebes*, n subsp Type 99954
Fig 4 —*Eulota gottschei* (Mlldff) Pukhan-san 99951
Fig 5 —*Eulota gottschei fusanica* n subsp Type 95857
Figs. 6, 7 —*Eulota gottschei* (Mlldff) Pukhan-san 99951

Figures all enlarged, the actual diameter indicated by lines under the face views.

PLATE XXXV —Figs 1, 1*a*, 1*b* —*Pyramidula micra* n sp Type 49557
Fig 2 —*Kaliella obesiconus* Pils. Type 95865
Fig 3 —*Kaliella kunsanica* n sp Type 141914
Fig 4 —*Kaliella serica* n sp Near Antung 99929
Figs 5, 5*a* —*Kaliella serica* n sp Type 99933
Fig 6 —*Kaliella coreana* (Mlldff) Seoul 99932
Figs 7, 7*a* —*Ganesella virgo* n sp Type, enlarged and natural size 99965
Fig 8 —*Kaliella coreana* (Mlldff) Photographic reproduction of von Moellendorff's figures.
Figs 9, 9*a* —*Chloritis problematica* n sp Type. Enlarged and natural size 99969
Fig 10 —*Succinea horticola koreana* n subsp Type 99947
Figs. 11, 12, 13 —*Succinea hirasei* Pils Sorai, Korea, 113688

Figures 7*a* and 9*a* natural size, the others variously enlarged as indicated

LAND MOLLUSKS (HELICIDAE) FROM CENTRAL AND NORTHERN CALIFORNIA

BY HENRY A. PILSBRY

The copious marine molluscan fauna of California offers more abundant rewards to the collector-naturalist than the inland mollusks, so that now after more than a half-century of ardent collecting in California, new species and races of land snails are still to be found, and important points respecting the old species remain to be cleared up by Californian malacologists A few forms sent by Dr G Dallas Hanna with others from various sources in the collection of the Academy have given occasion for the following notes

Group of *H. nickliniana*

Helminthoglypta nickliniana (Lea) Plate XXXVI, figs 5, 6, 7 (small form)

Of this common species a small form from Bolinas is figured here for comparison with the Point Reyes race described under the name of *Epiphragmophora tudiculata awania* Bartsch *H nickliniana* occurs in Marin Co typical in form, size, color and sculpture, and there are also various modified forms and races

In the lot from Bolinas, collected by Hemphill, the diameter is 23 to 24 mm , in another lot, 17 to 18.5 mm with 5½ whorls. Some examples of this lot seem scarcely distinguishable from selected shells of *Helminthoglypta nickliniana awania* (Bartsch) from Point Reyes, though in most *awania* the granulation is almost effaced and the color is a shade darker

At Tomales, Hemphill collected a small form of *nickliniana*, diam 18 to 19 mm These shells also approach *awania*, but differ by the more distinct granulation He sent these shells out as "*H californiensis* Lea, var "

The *nickliniana* group is certainly a complex one, but due to the influence of W G Binney and Hemphill, the races and related species appear to have been unduly lumped as forms of the divergent local species *H californiensis*[1] *H anachoreta* W G B. appears to be at least subspecifically, distinct Probably *H ramentosa* Gld.[8] is also distinguishable as a subspecies

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[1] J G. Cooper repeatedly contended that from Lea's description and figure of *H californiensis* it is clear that he did not have the well known Cypress Point shell, but an imperforate form of the species he described as *H nickliniana* in the same paper At my request, Dr Bartsch has examined Lea's specimens, and will shortly publish a note explaining the discrepancy

Helminthoglypta nickliniana awania (Bartsch) Plate XXXVI, figs. 1, 2, 3, 4

Epiphragmophora tudiculata awania Bartsch, Proc Biol Soc Washington, XXXII, 1919, p 247

Specimens of the original lot from Point Reyes are figured. It is a race of *H nickliniana* which appears to have been dwarfed by the conditions of existence on an exposed granitic headland Together with the reduction in size, the sculpture tends to become obsolete, though generally characteristic traces remain locally The specimens figured are from 14 3 to 19 3 mm in diameter. The type was 16 4 mm in diameter

The original reference of this form to *tudiculata* as a subspecies is of course quite out of the question It is clearly connected with *nickliniana*, and in a Transition Zone district, far from the range of *tudiculata* The latter is a species of the Lower Sonoran Zone Except in southern California, *H tudiculata* is not known to occur in or west of the Coast Range

Helminthoglypta nickliniana anachoreta (W G Binney) Plate XXXVI, figs. 8, 9, 10, 11

Helix anachoreta W G B, Proc. A N S. Phila. IX, 1857, p 185 ("all California"), Boston Journ Nat. Hist. VII, 1859, p 11, pl 2 (76), fig 5, reprinted in Terr Moll. U. S IV, 1859, p 11, pl 76, fig 5

Helix bridgesi Newcomb, Proc. Cal. Acad. Sci II, 1861, p 91 (San Pablo).

This race was described from a bandless individual, such as Plate XXXVI, fig 10, 10*a*, a typical specimen from the old collection of the A N S Phila. Absence of the dark band is not a racial character of course, but only a mutation occasionally seen in this and some other species Usually there is a rather narrow cinnamon-brown band with an indistinct pale border below.

It differs primarily from *H. nickliniana* by the greater depression, larger diameter and especially the much more open umbilicus which is only in small part concealed by the reflected columellar lip In sculpture it falls within the range of variation of *H nickliniana* and its race *H. n. ramentosa* (Gld.) It is densely granulose throughout, or in some examples, smoother around the umbilicus, and there is a fine, shallow malleation over most of the last whorl

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[8] It has long been recognized that *H reticulata* Pfr is identical with *ramentosa* Gld, according to Dr J G Cooper (Proc Cal Acad Sci. VI, p 16), both were out of the same lot of specimens from Mission Peak, 25 miles southeast of Oakland, sent to the describers by Dr Newcomb But in another place (Amer Journ Conch. V, p 208) Cooper stated that "Dr Newcomb sent Gould the types [of *ramentosa*] from Benicia " Also, *ramentosa* is "found chiefly on Mare Island near Benicia "

Specimens from Upper Lake, Lake Co , California, No 22904 C. A. S , collected by Dr G D Hanna, extend the known range of this subspecies northward[3] and also, I believe, in elevation, as they were collected at about 1500 ft The specimens show the same variation in sculpture as those from the Bay region, with granulation partly irregular, along the striæ of growth, partly in protractive trends (as in Plate XXXVII, fig 2*a*) There is considerable variation in width of the umbilicus, which is contained from 6½ to 9½ times in the diameter of the shell In several of the eight specimens a faint pale border may be seen above the dark band, lacking in others, all having a light border below the band, as usual The distinctness of the malleation varies, in some of the shells it is very weakly developed

Height 19 5, diam 27 5 mm , 6½ whorls
Height 18 3, diam 26 0 mm , 6 whorls
Height 16 3, diam 27 0 mm , 5½ whorls

Helminthoglypta contracostae (Pils.) Plate XXXVII, figs 3–11

A[rionta] ramentosa small var , W G Binney, Man Amer Land Shells, 1885, p 133, fig 108
Epiphragmophora californiensis var *contracostae* Pilsbry, Nautilus IX, Oct 1, 1895, p 72
Epiphragmophora contracostae Pilsbry, Nautilus XI, September 1897, p 54, 59
Epiphragmophora arnheimi Dall, Proc U S Nat Mus. XVIII, April 23, 1896, p 6 (no description, refers to Binney's figure) Proc U S N M , XIX, January, 1897, p 375 (description)

The depressed shell is rather solid, umbilicate, the umbilicus contained about eight times in the diameter, only a small part of it covered by the reflected columellar lip. The general color is chamois, with a deeper or antimony yellow streak behind the lip and a rather narrow cinnamon-brown band with a narrow, inconspicuous light border below Sculpture of fine, uneven, partly thread-like striæ unevenly cut into small rounded and oblong granules by impressions which have a more or less spiral trend parallel to the suture, but are often interrupted, or irregular, sometimes descending forwardly in small patches as in *H. nickliniana ramentosa* and others of the *nickliniana* group, on the base the granulation is in more regularly spiral order The 1½ embryonic whorls have weak, irregular granules and short wrinkles The lip is but little expanded and is well thickened within, especially the basal and columellar margins

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[3] Hemphill collected *H. n anachoreta* in Sonoma Co., but the specimens sent were not more exactly located.

Height 12 5, diam 18 3 mm , 5¼ whorls Type
Height 14 0, diam 20 2 mm , Topotype
Height 11 7, diam 18 0 mm , Topotype

Originally described from Byron Hot Spring (E H. White), a place southeast of Mount Diablo, Contra Costa Co , it has been found in abundance near San Pablo (J S Arnheim) and on Isabel Point (Mrs A E Bush) on the Bay side of the same county The type, hitherto not figured, is illustrated on plate XXXVII, fig 5 The lip is sometimes thickened more than is usual in this genus (fig 3, Isabel Point)

Two lots referable to *H contracostae*, though not typical, were taken by Dr. G D Hanna at Clear Lake, Lake Co No 22886, C. A S , three specimens, only one adult (Plate XXXVII, fig 8), is a rather thin form having fine, practically typical granulation, a rather wide last whorl and fully 5¼ whorls. Height 13, diam 20 mm

The other lot, No 22899, C A S , six examples (Pl XXXVII, figs 9, 10, 10*a*, 11) is practically typical in color and solidity, but shows spiral impressed lines more emphatic and continuous than in Contra Costa Co examples, though in this respect there is considerable variation among the Clear Lake specimens These shells are also a little larger than the Contra Costa County form, with 5¼ to very nearly 6 whorls

Height 15 4, diam 23 mm
Height 14, diam 21 mm

From the greater elevation of Clear Lake, about 1500 ft , one would not expect to find there a species of the low Bay region, but the differences are not great, and in fact the two lots from Clear Lake differ as much as either does from the types of the species Under these circumstances it appears inadvisable to segregate either as a named race

Helminthoglypta diabloensis (J G Cooper) Plate XXXVII, figs. 1, 1*a*, 1*b*, 2, 2*a*

Helix . . very likely a new species, J G Cooper, Proc. Cal. Acad. Sci III, 1866, p. 260

Helix diabloensis J G. Cooper, Amer. Journ Conch. IV, 1868, p 221 (based upon preceding reference); Trans. Amer Philos. Soc 1879, pp. 184, 185.

Lysinoe diabloensis J G. Cooper, Proc. A N. S. Phila. 1872, p. 150, pl. 3, figs. G, 2, 3, 4G

[*Arionta californiensis*] var *diabloensis* W G. Binney, Man. Amer. Land Shells, 1885, pp 135, 136, figs. 112 (?), 113

The chief characters of this species are: its depressed form, the conspicuous excavation around the small umbilicus, *the large* *number of whorls of the closely coiled spire*—from over six to seven—and finally the sculpture, consisting of fine striæ cut into oblong beads by protractive tangential impressions, or often irregularly, on the upper surface, and on the base close circular series of malleations The color is between ecru-olive and olive-ocher The pale borders of the band are often inconspicuous

Except in size, it appears to be rather constant in character The number of whorls and their close coil separate it from *H. n. ramentosa* and other forms of the *H nickliniana* series It appears to be a rather common species in its area, though not commonly recognized in collections

The specimens figured are from Oakland, collected by Hemphill. Others seen are from Napa and Yolo counties Cooper (Proc Cal. Acad Sci. VI, p 19) mentions it from Napa and Colusa counties. The type locality is not certainly known The type specimen, "supposed to have been obtained in the Mount Diablo Range by Prof Brewer" has been lost. Cooper later surmised that it came from where Brewer crossed the range near New Idria, lat 36° 30′, which led Edson (Nautilus XXV, p 70) to suspect that *diabloensis* was a form of *traski*. Cooper himself (1879) once suggested a relationship between *diabloensis* and *traski* Although he studied Californian helices for many years, wrote copiously upon them and criticized Binney's treatment freely, it must be admitted that his ideas of their relationships were often astray In his last treatment of the species Cooper stated that "the first specimen (was) obtained by Prof Brewer 'East of Mount Diablo,' " and he redescribed and figured the species from Cedar Mountain, 25 miles southeast of Mount Diablo.

There appears to be no reason to believe that Cooper's second description related to anything different from the original *diabloensis* In both descriptions it is made perfectly clear that the raised striæ along growth lines are cut by *forwardly descending* impressions, *tangential* to the suture, as in other forms of the *nickliniana* group (as illustrated in Pl XXXVII, fig. 2*a*). *H. traski*, in which there are spirals parallel to the suture, is thus expressly excluded from consideration.

There appears to be no reasonable foundation for the surmise that Brewer got the original specimen of *diabloensis* near New Idria; he probably picked it up in Contra Costa county. The range of the species as now known is from Alameda Co, to Napa and Yolo Counties, in the Upper Sonoran zone.

Group of *H. arrosa.*

Helminthoglypta arrosa (Gould).

This species is found from Santa Cruz Co. to Humboldt Co., in the coastal strip of the Transition Zone. I consider *Epiphragmophora exarata* var. *rubicunda* Rowell[4] a synonym of *H. arrosa*.

It is one of the most variable species. How many of the named races have sufficient constancy for subspecific distinction remains doubtful. Size is variable in most of the forms, and a continuous series from largest to smallest can be selected. The list follows, beginning with the large, mainly southern form.

H. arrosa (Gld.)
H. a. holderiana (J. G. Coop.)
H. a. stiversiana (J. G. Coop.)
H. a. marinensis (Pils.)
H. a. miwoka (Bartsch)
H. a. mailliardi n. subsp.
H. a. expansilabris (Pils.).[5]

Cooper described two varieties (Proc. Cal. Acad. Sci. VI, 1875, p. 16) var. *holderiana* from the "east side of San Francisco Bay along the first range of hills opposite the Golden Gate, for 15 miles north and south," and var. *stiversiana* from either Marin or Sonoma counties, exact place unknown. Both were figured by Binney, Man. Amer. Land Shells, 1885, p. 127. The types are not extant.

I identify as *H. a. stiversiana* some shells collected by Hemphill at Tomales, Marin Co., figured in plate XXXVIII, figs. 16, 17, 18, and plate XXXIX, fig. 2. It has the light color of *H. a. miwoka*, but is mainly of larger size. The spire varies from the normal low cone of typical *arrosa* to the high cone of *miwoka*. The umbilicus is generally, but not always, wider than in *miwoka*. Hemphill sent these shells out as "*H. nickliniana*."

Height 21.0, diam. 28.0 mm.; 6¼ whorls (fig. 16).
Height 21.5, diam. 28.3 mm.
Height 17.8, diam. 22.8 mm.; 6¼ whorls (fig. 17).

Helminthoglypta arrosa marinensis (Pils.). Plate XXXVIII, figs. 1, 2, 3; plate XXXIX, fig. 1. This is a small, glossy, copiously wrinkle-malleate form collected in Marin County by Hemphill and by J. S. Arnheim, the exact locality not stated. Traces of the fine *arrosa* granulation of the upper surface are present, usually weak but sometimes well developed The type lot, No 71432 ANSP, has a mustard yellow cast with isabella color streaks, but in another the hue is more ochraceous with tawny-olive streaks

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[4] Nautilus XVI, 1902, p. 52.
[5] Nautilus XII, 1898, p. 22. Near Eureka, Humboldt Co., California.

Height 17 5, diam 23 7 mm ; 6⅔ whorls

This form has been mentioned in the literature several times, Nautilus XI, 1897, p 89, XX, p 14, but has not been defined, and is introduced here to point out what it is The exact locality and the status of the form remain to be determined, and perhaps it may be found superfluous It appears to differ from *H arrosa stiversiana*, but collections from Marin Co more ample than I have seen, are requisite for final decision

Helminthoglypta arrosa miwoka (Bartsch) Pl XXXVIII, figs. 4 to 9 Pl. XXXIX, fig 3

Epiphragmophora californiensis miwoka Bartsch, Proc Biol Soc Washington XXXII, 1919, p 248

H a miwoka (Bartsch) from Point Reyes, Marin Co , differs from *H arrosa* by being smaller, diameter 19 to 25 mm , with a more elevated spire and much lighter colored periostracum, approaching a chamois tint The fine granulation and other sculptural features are the same

I do not understand the reference of this form to *H californiensis* as a subspecies So far as I know, nothing properly referable to *H californiensis* of authors (*H vincta* Val.) is found within a hundred miles of Point Reyes

Twelve miles from the end of the Point, Mr H N Lowe collected a small, elevated form of *H arrosa*, russet to cinnamon in color, 23–26 5 mm in diameter It is thus intermediate between *arrosa* proper and *miwoka* in size, with the color of the former and the shape of the latter In this connection it may be mentioned that Cooper, in his original account of *stiversiana*, referred to a Point Reyes shell as a small form of *stiversiana* He must have had *miwoka* or one of the transitions between that and *stiversiana*, such as the form just described

It is clear that *miwoka* is a dwarfed form of *arrosa* characteristic of the granitic region, but the relation of shell size and other characters to geologic formation is evidently indirect, since individuals with the features of *miwoka* occur also at Tomales with others approaching ordinary *arrosa* in size and shape.

Helminthoglypta arrosa mailliardi n subsp. Pl XXXVIII, figs. 10–15

Requa, Del Norte County, California. Type No. 21748, coll

C A S , collected with 17 other examples by S Maillard and C. Littlejohn. Cotype No. 142005 ANSP

The shell is thin, subglobose, obliquely, very narrowly umbilicate, the umbilicus more than half concealed by the reflected columellar lip, chamois colored, encircled with a narrow, chestnut-brown band with very inconspicuous pale borders above and below Surface glossy, embryonic 1½ whorls are nearly smooth, granulate, following whorls with curved, retractive, unequal striæ, moderately sharp, fading out on the base, the last whorl has in addition to these, a rather weak malleation, developed locally The last whorl descends to the aperture and is strongly convex below The narrow peristome is expanded and moderately thickened within, triangularly dilated at the columellar insertion.

Height	15 3	-mm ,	diam	20	mm ;	5⅓	whorls Type
"	13 3	"	"	17 5	"	5⅓	"
"	21 6	"	"	25	"	6⅓	"
"	14 5	"	"	16.6	"	5⅓	"
"	13 3	"	"	18	"	5⅓	"
"	15 4	"	"	19.7	"	5½	"
"	15 7	"	"	19	"	5½	"
"	17 0	"	"	21 4	"	5½	"
"	18 2	"	"	21 5	"	5¾	"

About a dozen specimens are nearly or quite adult, probably all were collected dead, though some are perfectly fresh The periostracum has faded to chamois color in part of the specimens.

As will be seen by the measurements and figures, the size varies to an unusual degree The sculpture is also variable, a few shells being more inflated than the type, thin and almost smooth, the striæ and malleation very weakly developed (fig. 14)

One shell included with this lot is larger and more solid than the rest. It has lost the periostracum. This specimen is practically indistinguishable from some Marin Co examples of *H. arrosa miwoka* Further collections are required to decide the status of this form It measures: height 21 6, diam 25 mm ; 6⅓ whorls (Plate XXXVIII, fig. 15)

In general appearance, *E. arrosa maillardi* resembles the Point Reyes forms described as *Epiphragmophora tudiculata awania* Bartsch and *E californiensis miwoka* Bartsch. The smaller more delicate examples resemble *awania* superficially, but differ in details of sculpture; the larger ones approach *miwoka*. *H. a. maillardi* is evidently to be viewed as a somewhat convergent race of the same species, *H. arrosa*

Group of *H. tudiculata*

Helminthoglypta tudiculata cypreophila ('Newc', B & B) Plate XXXIX, figs. 5, 6 plate XL, figs. 1 to 4a.

H [*elix*] *cypreophila* Newc, W G Binney and T Bland, Land and Fresh Water Shells of North America, Part I, 1869, p 166, fig 287 (Copperopolis)

[*Arionta tudiculata*] form *cypreophila*, Binney, Bull M C Z XXII, No 4, 1892, p 187, pl 2, figs. 7, 8 (not typical)

Epiphragmophora tudiculata colusaensis Bartsch, Nautilus XXII, April, 1919, p 126

This form was defined over fifty years ago by Binney's figure of the type from Copperopolis, Calaveras Co It inhabits foothills of the eastern slope of the interior valley of California from Fresno to Yuba Co, and in the north it spreads westward across the Sacramento River (but east of the Coast Range) at least as far as the northern part of Colusa Co. It appears thus to be here, as *H tudiculata* is in southern California, a species of the Lower Sonoran Zone, which, as mapped by Grinnell[6] extends in the north across the Sacramento River into Glenn and Colusa Counties

The typical forms of *cypreophila* found in the northern counties, Calaveras to Yuba and Colusa, are less malleate than those further south in Merced, Madera, and Fresno Counties, the latter approach the profusely malleate condition of typical *H tudiculata*, and are, indeed, a transitional stage between *cypreophila* and *tudiculata*

The shell is thin, half-covered umbilicate, between isabella color and ecru-olive, with narrow paler bands, bordering the chestnut-brown band, which is narrow and often rather pale In the sculpture, fine rather sharp striation predominates on the upper surface, but in places there is more or less malleation, lower surface less sharply striate, with more malleation chiefly on the peripheral half. Immediately behind the lip the surface is *minutely granulose*, especially back of the upper angle and in the umbilicus This character I do not see in typical *H tudiculata*. Specimens of a lot from Calaveras Co. vary in height of the spire from rather high, as in Binney's figure, to lower than those figured here. Three of this lot measure.

Height 17 mm, diam 27 mm
Height 17 5 mm, diam 25 mm
Height 17 mm., diam 24 mm

The type of *colusaensis*, kindly lent me by Dr Bartsch (Pl XXXIX, fig. 6, Pl. XL, fig 1, 1*a*), measures, height 16, diam

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[6] A Distributional List of the Birds of California, map facing p 8. Cooper Ornithological Club, 1915.

24 4 mm Its band is rather light, the pale borders weakly marked There is less malleation than in some Calaveras specimens, though it is fairly well developed *Colusaensis* has no racial characters distinct from *cypreophila,* living in the same life zone.

A specimen of *H t cypreophila* from Brown's Valley, Yuba Co, No 8780 C A S., collected by Hemphill, measures, height 15 2 mm, diam 25 mm, being rather depressed for this subspecies The color is between ecru-olive and deep colonial buff It is finely malleate on the last half whorl but elsewhere striate with very slight traces of malleation. Figs. 2, 2*a*.

In this connection I may mention that the form I described in 1898 as *E tudiculata umbilicata* belongs to the *dupetithouarsi* series, which will be considered in a future paper

Monadenia mormonum hirsuta new subspecies. Plate XL, figs. 6 to 8

Mountain Pass, Tuolumne Co, California Type No 21513 C A S, 11 other specimens Paratypes No 142003 ANSP.

The shell is depressed, umbilicate, the umbilicus contained nearly eight times in the diameter, rood's brown, with a slightly darker peripheral band with buff bands of nearly equal width above and below it The surface is dull, the initial 1½ whorls finely, evenly and rather sharply granular, the granules locally arranged in descending protractive and retractive trends but largely irregularly placed; next whorl also granular, subsequent whorls microscopically wrinkled and set with short, curved bristles standing in oblique trends, though the arrangement is partly somewhat irregular, the bristles on the last whorl are about 0 5 mm long, 0 4 to 0 7 mm apart. The whorls increase slowly, the last being indistinctly subangular in front and descending a little to the aperture. Aperture elliptical-lunate, about as in *M m buttoni*

Height 14, diam 22 5 mm 5¾ whorls Smallest
Height 13, diam 23 4 mm., 6 whorls
Height 16.6, diam 24 mm, 6½ whorls.
Height 15 3, diam 24 8 mm ; 6½ whorls Type
Height 17, diam 26 6 mm., 6½ whorls Largest

Of the several described races of *M. mormonum,* this stands nearest to *H m. buttoni* Pils., but in the most depressed specimens the last whorl is less depressed than in that subspecies, the hairs are longer and more persistent and the minute sculpture much coarser If colonies of intermediate character exist, I have not seen them

Monadenia mormonum loweana new subspecies. Plate XL, figs. *5*, *5a*, *5b*.

Road to Huntington Lake, in the San Joaquin river canyon, collected by H N Lowe.

The shell differs from typical *M. mormonum* by its dull surface Sculpture of very fine, close, irregular spiral lines and sparse low tubercles lengthened in a spiral direction, partly obsolete on the last whorl and wanting in the umbilical region Umbilicus much wider than in *mormonum* or any of its described subspecies The shoulder band has distinct light bordering bands.

Height 14 mm , diam 25 5 mm

This form approaches *M infumata* by its dull surface and sculpture, though this is more developed in *infumata*, it is obviously more related to *mormonum*, which has a glossy periostracum. In one of the young specimens there are very short subtriangular epidermal processes on the low tubercles where protected near the suture, but they are very different from the hairs of *M m hirsuta*.

Hanna and Rixford[7] have called attention to the wide variation found in the *mormonum* series It appears to me necessary to have names for salient local forms, several of them being very distinct in appearance and in the development of sculpture

Explanation of Plates XXXVI to XL

Plate XXXVI —Figs. 1-4 —*Helminthoglypta nickliniana awania* (Bartsch) Point Reyes. 118214 ANSP

Figs. 5, 6, 7 —*H nickliniana* (Lea), small form from Bolinas. 10755 ANSP.

Figs. 8-8*b*, 9-9*b*, 11 —*H. nickliniana anachoreta* (W G B). Upper Lake, Lake Co , 22904 C A.S

Figs. 10, 10*a*.—*H n. anachoreta* (W G B) Bandless example, 1878 ANSP.

Plate XXXVII.—Figs. 1, 1*a*, 1*b*, 2, 2*a*.—*Helminthoglypta diabloensis* (J G. Cooper) Oakland. 10722 ANSP

Fig 3 —*H contracostae* (Pils.). Point Isabel, Contra Costa Co 10716 ANSP

Figs. 4, 5, 6, 6*a* —*H. contracostae* (Pils.) Byron Hot Springs, Contra Costa Co 10712 ANSP Fig 5 represents the type.

Fig 7 —*H contracostae* (Pils.) San Pablo 71426 ANSP

Fig. 8.—*H contracostae* (Pils.) Clear Lake, Lake Co 22886 C A S

Figs. 9, 10, 10*a*, 11 —*H. contracostae* (Pils.) Clear Lake, Lake Co 22899 C.A.S.

Plate XXXVIII.—Figs. 1, 2, 3.—*Helminthoglypta arrosa marinensis* (Pils.) Marin Co. 71432 ANSP Fig. 2 is the type.

Fig. 4.—*H arrosa miwoka* (Bartsch), large form from Point Reyes, collected by Hanna and Rixford. 130053 ANSP.

Figs. 5, 6, 7, 8, 9 —*H. arrosa miwoka.* Point Reyes. Part of original lot, collected by H. N. Lowe, 118215 and 118217 ANSP.

Figs. 10, 12, 13, 14, 15.—*H arrosa mailliardi* n subsp Requa. 21759 C A.S.

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[7] Proc. Cal. Acad Sci. XII, No 4, 1923, p 43

Fig 11.—*H. arrosa mailliardi* n subsp Requa. Type. 21748 C A.S.
Figs. 16, 17, 18.—*H arrosa stiversiana* (J. G Cooper) Tomales, Marin Co. 10754 ANSP

PLATE XXXIX.—Fig 1.—*Helminthoglypta arrosa marinensis* (Pils.) 71432 ANSP.
Fig. 2.—*H a. stiversiana* (J. G. C), = pl. 38, fig. 17
Fig. 3.—*H a miwoka* (Btch), = pl. 38, fig. 4.
Fig 4.—*H a stiversiana* (J. G C.), = pl 38, fig. 16.
Fig 5.—*H tudiculata cypreophila* (Nc), = pl. 40, figs. 4, 4*a*.
Fig 6.—*H tudiculata cypreophila* (Nc) = pl. 40, fig. 1, 1*a*. Holotype of *Epiphragmophora tudiculata colusaensis* Bartsch.

PLATE XL.—Figs 1, 1*a*.—*Helminthoglypta tudiculata cypreophila* (Nc) Holotype of *Epiphragmophora tudiculata colusaensis* Bartsch, 334721 USNM
Figs. 2, 2*a*.—*H t cypreophila* (Nc) Brown's Valley, Yuba Co 8780 C.A.S.
Figs. 3, 3*a*, 4, 4*a*.—*H t cypreophila* (Nc) Calaveras Co. 68132 ANSP
Fig. 5.—*Monadenia mormonum loweana* n. subsp Sculpture of a paratype.
Figs. 5*a*, 5*b*.—*Monadenia mormonum loweana* n. subsp Type. 141568 ANSP
Figs. 6, 6*a*.—*M mormonum hirsuta* n. subsp Type, C A S.
Figs. 7, 8.—*M mormonum hirsuta* n subsp Paratypes.
Figures 5 and 6 × 5

ABSTRACTS OF THE MINUTES OF THE PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

1926

JANUARY 19, 1926

Stated Meeting

Thirty members present The President, Dr R A. F Penrose, Jr , in the Chair

The presentation of a portrait of the late John Cadwalader, President of the Academy 1918–1922, was announced

The resignation of Mr Owen Wister as a member of the Board of Trustees was accepted with regret The resignation of Dr M. Carey Thomas as a member of the Academy was similarly accepted

The selection of Dr William Berryman Scott, Professor of Geology at Princeton University, for the 1926 Hayden Memorial Geological Award was announced

Lionel T. Herzberg was elected a Junior Member of the Academy.

Nominations were made for President, Vice-President, Secretary, and Treasurer, to serve from the February, 1926, meeting to that of 1927, and of members of the Board of Trustees to fill two unexpired terms, one of one year and one of two years, and two full terms of three years

FEBRUARY 16, 1926

Annual Meeting

Thirty-three members present The President, Dr R A F Penrose, Jr , in the Chair

Annual reports covering the year 1925 were presented by the Secretary, Treasurer, auditors of the Treasurer's accounts, Treasurer of the "Manual of Conchology," Director of the Museum, Librarian, and Publication Committee

The following officers and members of the Board of Trustees were elected, to serve until the Annual Meeting of 1927 unless otherwise indicated: *President*, T. Chalkley Palmer; *Vice-President*, Henry Skinner, *Secretary*, James A. G. Rehn; *Treasurer*, George Vaux, Jr , *Board of Trustees* to serve one year (until 1927), John Ashhurst; to serve two years (until 1928), Spencer Trotter; to serve three years (until 1929), George L Harrison and Frank J Keeley.

The resignations of John J. Howard and Dr Peter M Keating as Annual Members were accepted

Edgar S. McKaig was elected a Life Member of the Academy

MARCH 16, 1926

Stated Meeting

Twenty members present The President, Mr T Chalkley Palmer, in the Chair.

A resolution thanking Dr R A F. Penrose, Jr, for his gift of furnishings, rugs, pictures and cases, which he had placed in the office of the President of the Academy, was adopted

A report from the Board of Trustees transmitted actions taken and appointments made at their meeting of February 23, 1926.

APRIL 13, 1926

Special Meeting, called by the President, and held in the Lecture Hall

Twenty-eight members, one correspondent (Dr. Scott), and forty visitors present The President, Mr T Chalkley Palmer, in the Chair.

The President stated that the purpose of the meeting was to present the nineteenth Hayden Memorial Geological Award to Dr. William Berryman Scott.

The history of the award was outlined by the President, and attention called to some of the distinguished scholars to whom the award had been made in the past The award to Dr. Scott was made on the unanimous recommendation of the committee charged with selecting the recipient, which action subsequently was unanimously approved by the Council of the Academy. The nomination of Dr. Scott was made by the committee "in recognition of his many researches and publications in the field of vertebrate paleontology, especially that of South America, as described in the Reports of the Princeton University Expeditions to Patagonia and in other memoirs "

After the President had formally presented the award to Dr. Scott in the name of the Academy, Dr Scott, in accepting, expressed his appreciation of the honor and also his deep obligation to the Academy and its workers of years ago, such as Hayden and Leidy, for their encouragement of his early work

Dr. Scott then addressed the Academy on "The Migration of Mammals in Geological Times"

William Berryman Scott was born in Cincinnati, Ohio, February 12, 1858. In 1877 he was graduated from Princeton University, with the degree of Bachelor of Arts, while in 1880 he received that of Doctor of Philosophy from the University of Heidelberg The University of Pennsylvania subsequently conferred upon him the Doctorate of Letters, and Harvard University and the University of Oxford that of Science

Appointed Assistant Professor of Geology at Princeton University in 1880, he was made Blair Professor of Geology and Paleontology in 1884, and has remained a member of the faculty of his Alma Mater since that time

His first contribution to vertebrate paleontology, a science toward the advancement of which he has so greatly assisted, was published in 1878, in conjunction with Henry Fairfield Osborn and Francis Speir From that time, have appeared from his pen, many contributions to vertebrate paleontology and geology, the earlier ones dealing largely with the deposits of our Western States, those of the last twenty years mainly monographs of the extensive and exceedingly important collections assembled in Patagonia by the several Princeton Patagonian Expeditions From the paleontological reports of these expeditions, all edited and largely written by Dr Scott, we have been able to form a most comprehensive idea of the Tertiary mammalian fauna of extreme southern South America

The most notable works of a semi-popular scientific or text-book character from Dr Scott's pen are a "History of Land Mammals in the Western Hemisphere," and his well-known and widely used "Introduction to Geology"

Of Dr. Scott's numerous contributions quite a few were published in the Proceedings of this Academy In addition to his geological and paleontological studies, Dr. Scott has contributed important papers on the development of certain recent fishes and batrachians.

A member of the National Academy of Sciences and of the American Philosophical Society, of which he was first Vice-President, then President for a number of years, Dr Scott is also a correspondent of this Academy, a member of the Zoological Society of London, a fellow of the Linnean Society of London, a member of the Geological Society of London, and of numerous other notable scientific organisations. In 1910 the Wollaston Medal was awarded to Dr. Scott by the Geological Society of London, in recognition of his work in paleontology.

APRIL 20, 1926

Stated Meeting

Seventeen members present. The President, Mr T. Chalkley Palmer, in the Chair

The resignation of Dr. Alfred J. Ostheimer, as a member, was accepted with regret

The death of Ezra T Cresson, long a member of the Academy and a founder of the American Entomological Society, was announced

The Hon William C Sproul, E Wallace Chadwick, E Shirley Borden, George B Kaiser, and Joseph A Steinmetz, were elected members

The Academy adjourned to reconvene the third Tuesday of May.

MAY 18, 1926

Adjourned meeting of the session of April 20, 1926, reconvened by action taken April 20, 1926

Twenty-one members present The President, Mr T Chalkley Palmer, in the Chair

The resignation of Dr David R Bowen, as a member, was accepted with regret

The deaths of Mrs Henry Carvill Lewis, Samuel Price Wetherill, and Arthur W Pusey, members, were announced.

The following individuals were elected members. Niles S. Babbitt, Daniel Moore Bates, Harold F Bernhardt, Arthur Bloch, Bernard Bloch, Jay Boyd, Miss Mary A. Burnham, Henry Paul Busch, W B. Chamberlin, Radcliffe Cheston, Jr , James B Clark, Samuel M Clement, Jr., Morris L Clothier, Henry H Collins, George J Cooke, Philemon Dickinson, Dr John C Donaldson, Dr T McKean Downs, Charles J Eisenlohr, Carl W. Fenninger, Thomas Fisher, Mrs Thomas Fisher, George H Frazier, Alfred Cope Garrett, F. Stanley Groves, Jr , E Marshall Harvey, Edward F Henson, Samuel Horner, Jr , Walter C Janney, Jr., C. Hartman Kuhn, Edward J. Lavino, Edmund B. Leaming, Mrs John Frederick Lewis, Robert R. Logan, Lewis N. Lukens, Jr , George H. McFadden, Miss Mary E McGill, Frederick McOwen, Mrs Campbell Madeira, Miss Jessie W. Masters, Charles P. Maule, Thomas James Meagher, Mrs. Samuel Vaughan Merrick, Henry S. Morris, F. Eugene Newbold, W. Austin Obdyke, Mrs Albert

Pancoast, Frank T Patterson, A J Drexel Paul, J Howard Pew, Beverley R Potter, Miss Anna Randolph, Miss Louisa Rawle, William H Ridgway, Mrs. Lewis A Riley, Charles H Roberts, G Brinton Roberts, Henry R Robins, Harry W Schlehner, Miss Helen Semple, Stephen J Simon, Mrs Alfred G. B Steel, Dr William H Teller, Miss Mabel L H Thomas, Mrs W Hersey Thomas, J Barton Townsend, Mrs George F Tyler, Charles Wheeler, John T Windrim, James D Winsor, Jr, Henry N Woolman, Alexander C Yarnall, C. C Zantzinger, Dr M W Zimmerman. *Junior Member* —Robert H Fleisher

The Academy adjourned to reconvene June 8, 1926

JUNE 8, 1926

Adjourned meeting of the session of April 20, 1926, reconvened by action taken May 18, 1926

Nineteen members present The President, Mr T Chalkley Palmer, in the Chair

The resignations of Mr and Mrs Franklin D'Olier, as members, were accepted with regret

The death of Dr Henry Skinner, Vice-President and Curator of Entomology of the Academy, was announced

The following minute, presented by Dr Witmer Stone, was unanimously adopted by the Academy and ordered spread upon the minutes:

The Academy of Natural Sciences of Philadelphia, conscious of the great loss that it has sustained in the death of its Vice-President, Dr Henry Skinner, desires to place on record its appreciation of the service rendered by him to this institution and to the scientific world.

Graduating from the college department of the University of Pennsylvania in 1881, and from the Medical School in 1884, he passed sixteen years in the practice of medicine, and then retired in order to devote his entire time to entomological research, which had from early youth been his chief interest and which he desired to make his life work.

Joining the Academy in 1881 he at once became identified with the Entomological Section and with the American Entomological Society, and in 1900 assumed the position of Curator of Insects. He served also for many years as a Councillor of the Academy, as a member and Chairman of the Publication Committee, as Editor of "Entomological News," and in many other capacities, while he had been State Entomologist of Pennsylvania, President of the Entomological Society of America and of the American Entomological Society, and a member of the International Commission on Zoological Nomenclature

Throughout his life he had the welfare of the Academy constantly at heart and worked zealously for the general interests of this institution The development of the Entomological Department was his especial aim and ambition and to this he unselfishly devoted his life, with the result that its present high standing and world wide reputation will stand as a memorial to his energy and ability

Dr. Skinner was one of the pioneer investigators of the relation of insects to disease, and both by his lectures and writings did much to educate the public as to the menace of insect life and the need of combating it, while as a specialist in the Lepidoptera his reputation was international.

Of a delightful personality he did much to interest others in the work in which he was engaged, while his kindly and generous disposition endeared him to all with whom he came in contact

In his passing the Academy has lost an officer and investigator of ability and his scientific associates a lovable companion and a true and loyal friend

The following individuals were elected *Correspondents*—Henry Balfour, University Museum, Oxford, England, Erwin Baur, Royal Agricultural College, Berlin, Germany, Joseph Grinnell, University of California, Berkeley, California; Michael Guyer, University of Wisconsin, Madison, Wisconsin, Fritz Hass, Senckenbergische Naturforschende Gesellschaft, Frankfurt a/M, Germany, Gotthelf Carl Huber, University of Michigan, Ann Arbor, Michigan; A F Basset Hull, Box 704, G P O, Sydney, New South Wales; Chiyomatzu Ishikawa, Imperial University, Tokyo, Japan, Bunjiro Koto, Imperial University, Tokyo, Japan; Samuel Ottman Mast, Johns Hopkins University, Baltimore; Maryland; Herbert Osborn, Ohio State University, Columbus, Ohio; Carlos Emilio Porter, Museo Nacional, Santiago, Chile, Norman Denbigh Riley, British Museum of Natural History, London, England, Erwin Frank Smith, U S Dept of Agriculture, Washington, D C; Alexander Wetmore, U S National Museum, Washington, D. C, August Weberbauer, c/o German Legation, Lima, Peru; W Wenz, Senckenbergische Naturforschende Gesellschaft, Frankfurt a/M, Germany. *Members.*—N Emory Bartlett, James H. Beattie, E. W. Clark, Dr Martin B Culver, Clarence W Dolan, H Yale Dolan, William R Ellison, J Campbell Gilmore, James E. Gowen, R. Sturgis Ingersoll, Howard Ketcham, Archibald O Leighton, Stacy B. Lloyd, W. J. McCahan, Jr, John A McCarthy, Miss Elizabeth Canby Morris, John G Pew, Joseph G. Rosengarten, Jr., Mrs. J.

Henry Scattergood, Miss Hannah Lewis Scott, Miss Mary Grubb Smith, William Howard Smith, Mrs Edward T Stotesbury, Harold R Tawresey, H Birchard Taylor, Edward Y. Townsend, J. B. Townsend, Jr , John Price Wetherill, Jr , *Junior Member* — Francis L Van Dusen.

NOVEMBER 16, 1926

Stated Meeting

Seventeen members present Dr Pilsbry in the Chair

The resignation of Mrs. C Lincoln Furbush, as a member, was accepted with regret

The qualification of Mr T Chalkley Palmer as a Sustaining Member of the Academy was announced

Gifts of the portraits of Dr Richard A F Penrose, Jr , and Dr. J Brackenridge Clemens, were also announced The portrait of Dr Penrose, ex-President of the Academy, was presented by him at the request of the Council Dr Clemens was the pioneer American student of the Microlepidoptera, and his collections are now deposited with the Academy His portrait was presented by his sons, Dr James B Clemens, of New York, and Maurice Clemens of Easton, Penna

The deaths of Harold Wingate, Dr Clayton D Fretz, Bayard Henry and George H. McFadden were announced

The following individuals were elected members.—Thomas Cadwalader, G Dawson Coleman, Clement A. Griscom, 3rd , Gilbert Mather, Arthur E Pew, Jr , E F Rivinus, W. Plunket Stewart, Dr W Hersey Thomas, Charles N Welsh, William West, J Kent Willing, Miss Lila M Wright.

DECEMBER 21, 1926

Stated Meeting

Nineteen members present Mr. T Chalkley Palmer, President, in the Chair.

The resignations of Howard Crawley and F J Chesterman, as members, were accepted with regret.

The deaths of W. Moylan Lansdale and Jules Mastbaum were announced.

The following individuals were elected members: *Sustaining Member.*—Boies Penrose, 2nd *Life and Annual Members.*—William S. Acuff, Perry S. Allen, John S Arndt, Leonard C. Ashton, Francis L Bacon, Mrs Albert L Baily, R M Baily, David G Baird, Mrs Ellis Ames Ballard, Miss Emily Barclay, E N. Benson, Jr, Mrs E N Benson, Jr, Louis J Bergson, Mrs Arthur Biddle, Miss E. F Biddle, Livingston L Biddle, Miss Harriet E. Blakiston, Dr. P Brooke Bland, Morris R. Bockius, Harold Boericke, James Bond, Dr L Napoleon Boston, J Harry Bowers, Miss Emilie C. Bradbury, Robert S Bright, Clarence C Brinton, John T Brosnan, Andrew V. Brown, R Nelson Buckley, Louis Burk, E Lewis Burnham, Miss M Theodora Burt, Richard M Cadwalader, Jr, Mrs Richard M Cadwalader, Jr, George C Carson, Jr, Ellwood B Chapman, Oswald Chew, Thomas W. W. Clay, Peyton S Cochran, Henry Hill Collins, 3rd, John W Converse, Mrs Newton W Corson, Elliott Curtiss, George C Davies, Mrs Charles P. Davis, S Delbert, Jr, Baroness de Schauensee, James A Develin, Jr, Frederick M Devlin, Dr Edward B Dewhurst, Charles L. Dexter, Charles D Dickey, Dr John Diven, Joseph M Dohan, Dr John T Dorrance, George W C Drexel, Alfred I. du Pont, Adolph Eichholz, Fred J Ennis, Dr C A Ernst, Robert P Esty, Mrs Robert P Esty, Charles Evans, Frederic N Fell, J Sibley Felton, Mrs. Alfred W Fleisher, Henry H Fleisher, Edward T. Fleming, William T. Fleming, Mrs Frank B. Foster, William A. Foster, Addison B Freeman, Ernest W French, Charles W Gamble, A B Geary, Jacob E Gegenheimer, Alexander P Gest, Dr John H Gibbon, Herbert N Goldsmith, W. Griffin Gribbel, J B. Hamilton, B. Frank Harper, C Addison Harris, Jr., W Welsh Harrison, Jr, Spencer P Hazard, Daniel L Hebard, R E Hellmer, Mrs. T Charlton Henry, Mrs. E Caven Hensel, Shelton A Hibbs, Walter W Holmes, Herbert Hope, Edward Hopkinson, Jr, George Howe, John H W. Ingersoll, C H Krumbhaar, Jr, Henry M McAdoo, John Franklin McCahan, Robert McLean, Austin G. Maury, Dr Withrow Morse, Edward Norris, Dr Howard Y. Pennell, Theodore W Reath, Dr. John Stewart Rodman, Nicholas G. Roosevelt, Henry W Roth, Thomas M Royal, Maurice Bower Saul, Walter Biddle Saul, N. M Seabrease, Arthur W Sewall, W J Sewell, Jr, Mrs Isaac Tatnall Starr, C Frederick C Stout, Miss Frances L. Sullivan, John Borland Thayer, 3rd, Walter Thayer, Mrs Justice M. Thompson, Andrew Van Pelt, Mrs Alexander Van Rensselaer, Clement R. Wainwright, T. Johnson Ward, Douglas R. Warfield, William M. Weaver, W Nelson L. West, A Heckscher Wetherill, David E Williams, 3rd., E S.

Willing, Joseph Wood, Jr *Associate Member*—Miss Mary E Deeter (Reading, Penna) *Junior Members*—Ethel Benson, Perry Benson, Peter Benson, Richard Benson, Isabella Marie Hellmer, Joseph R Hellmer

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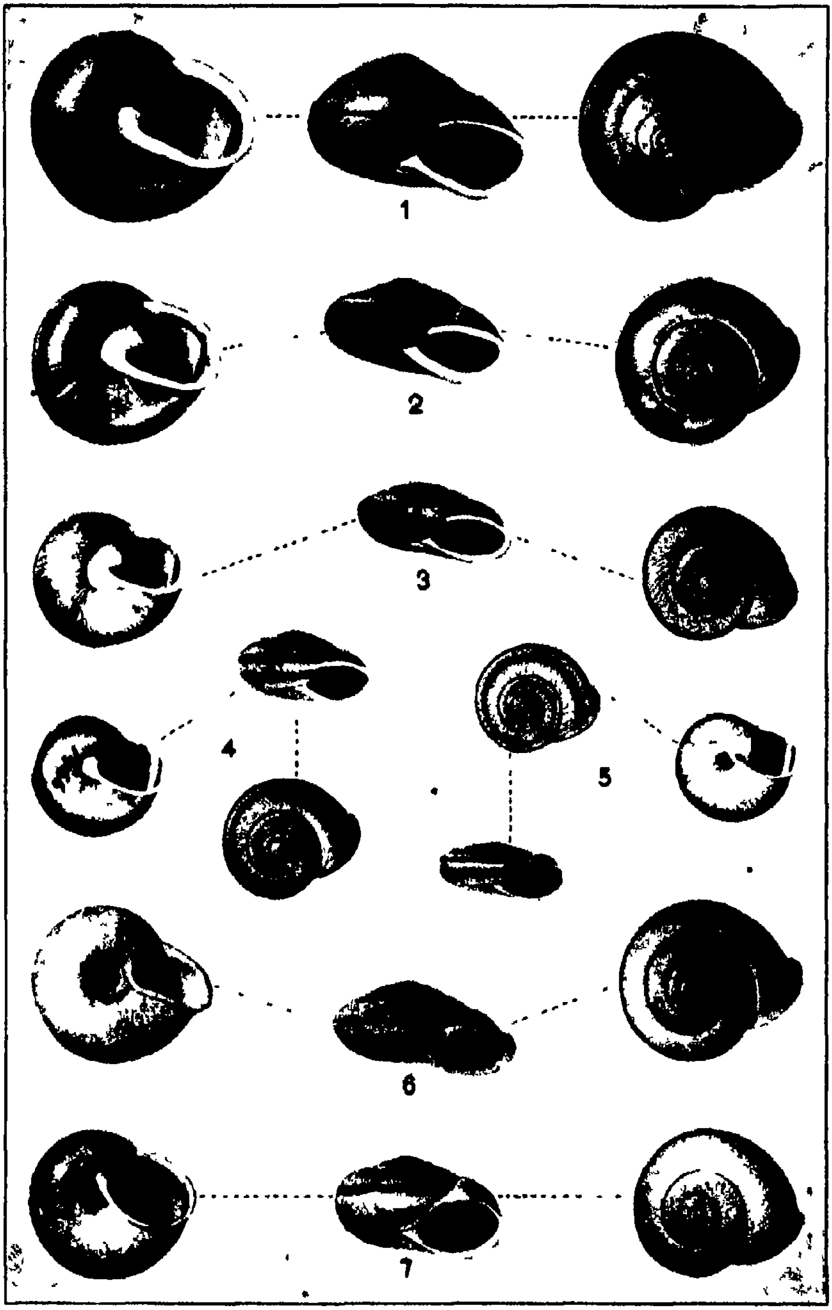

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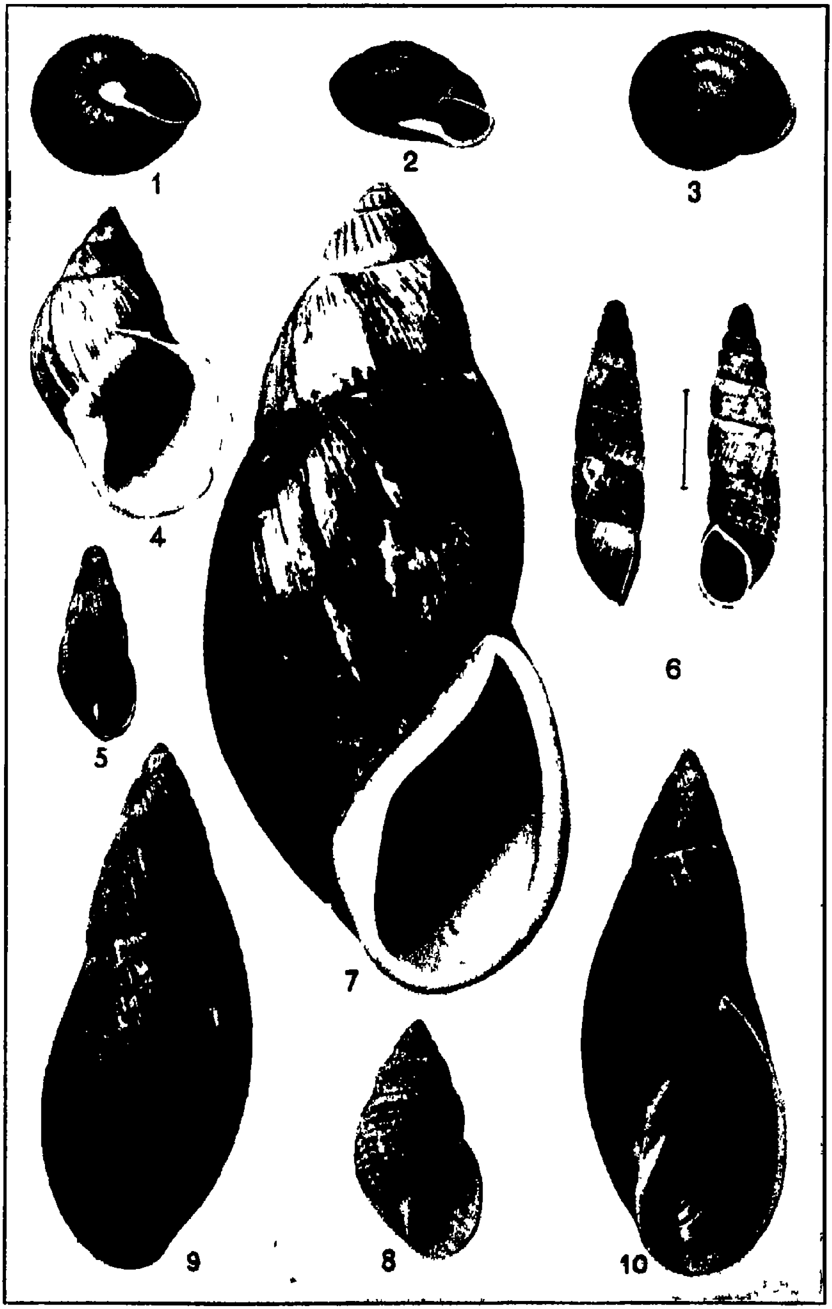

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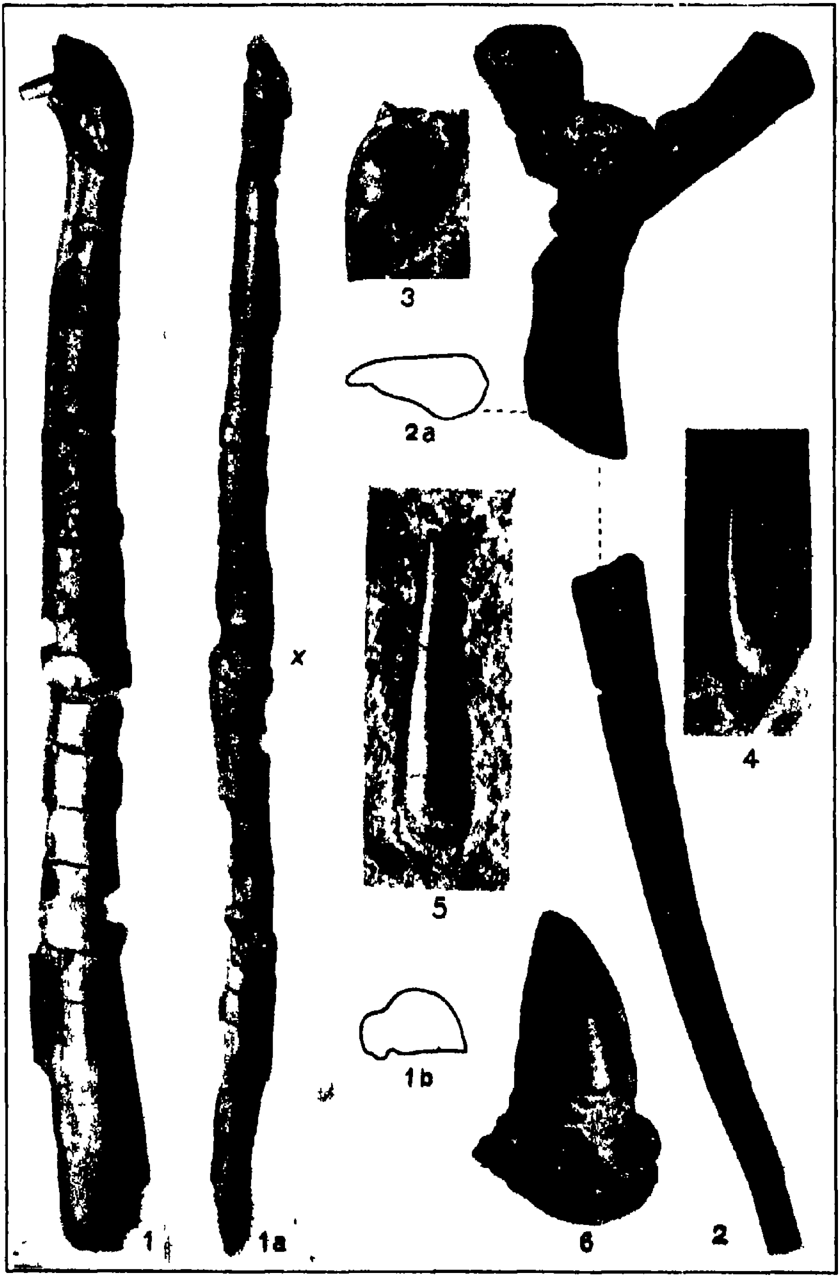

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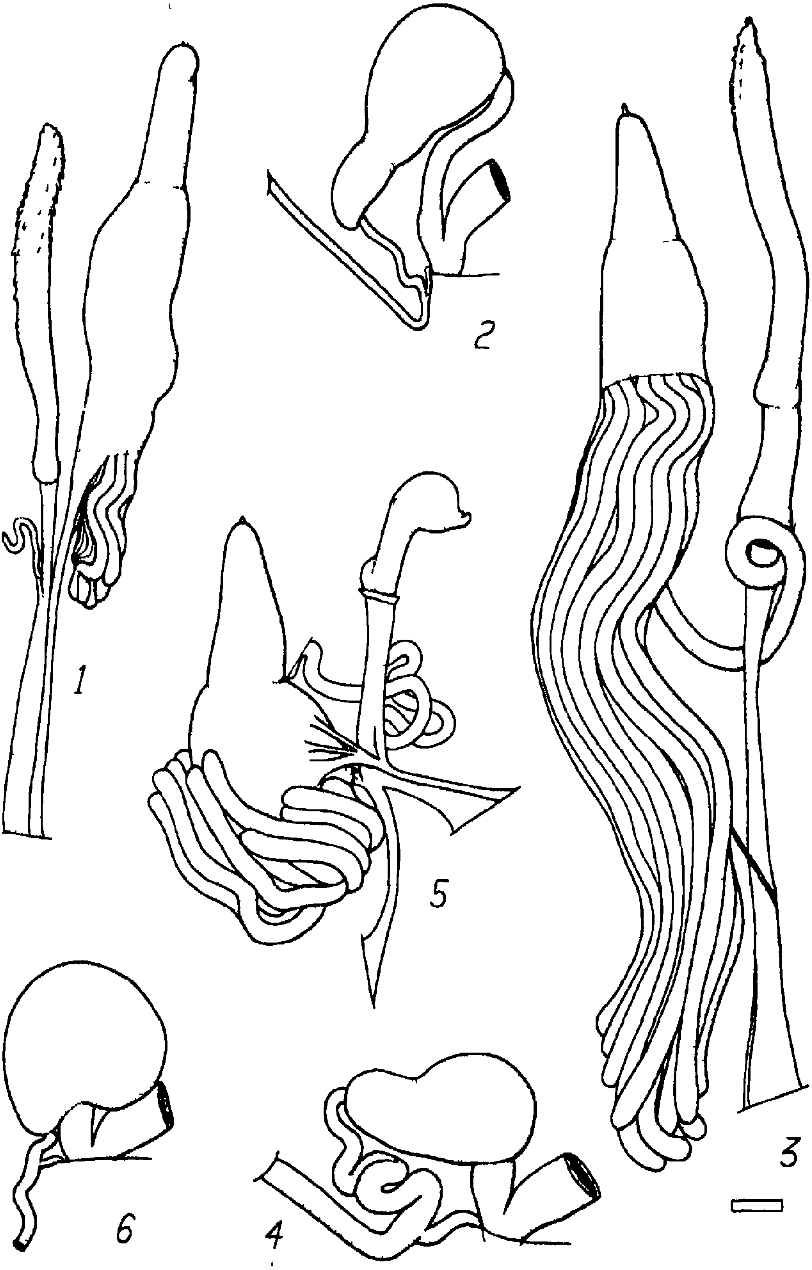

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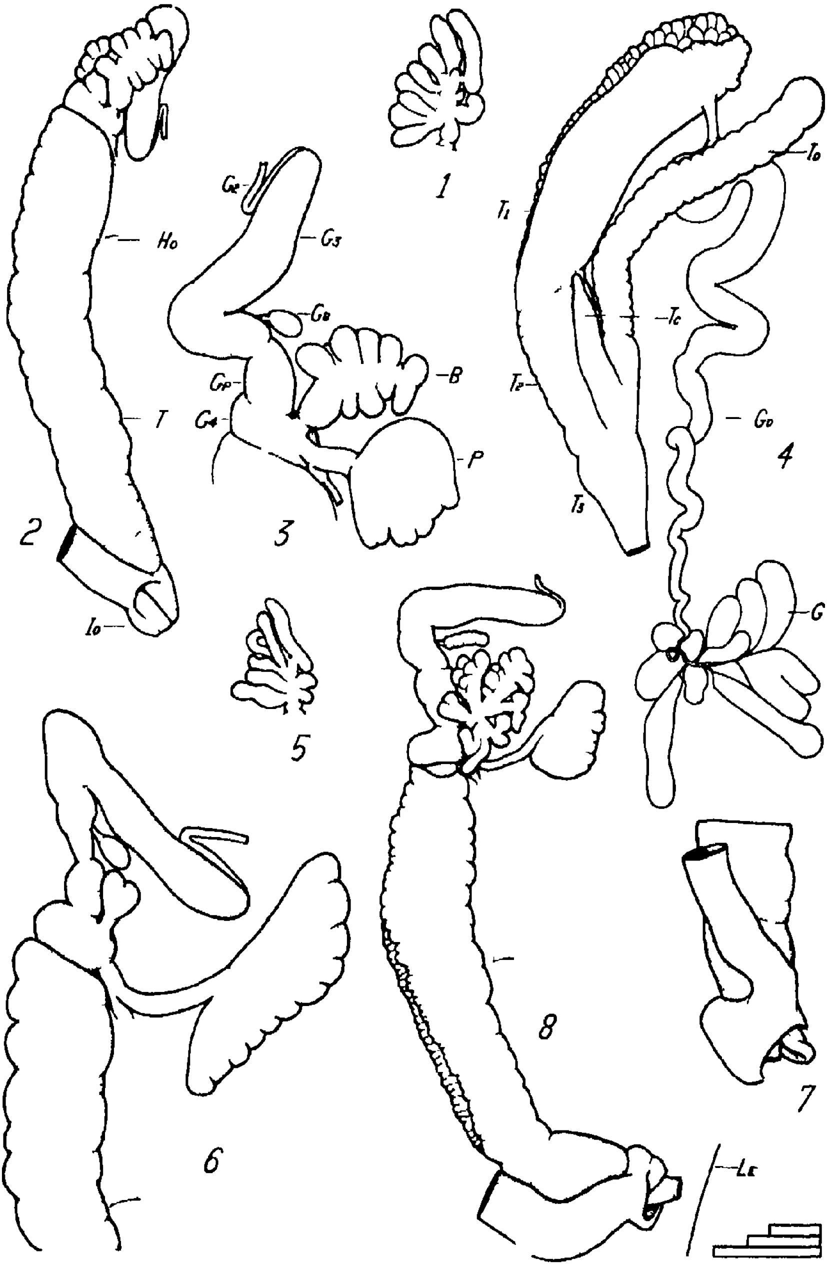

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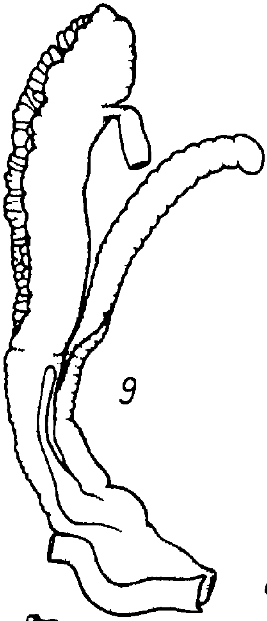

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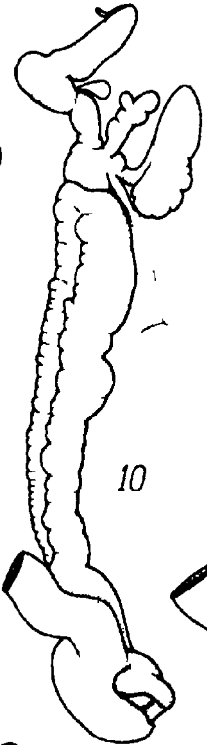

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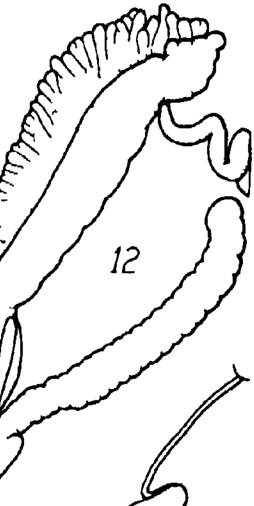

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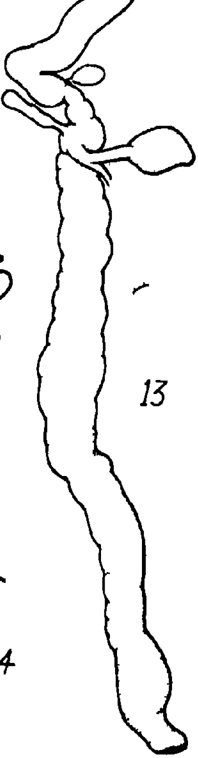

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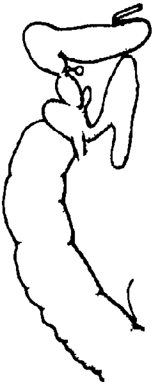

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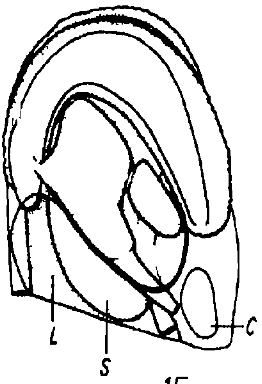

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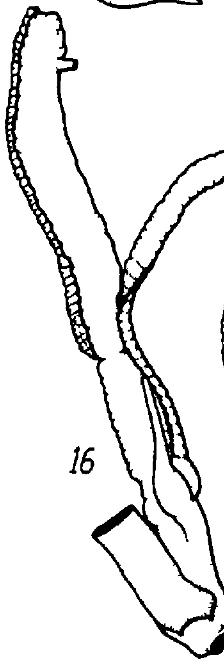

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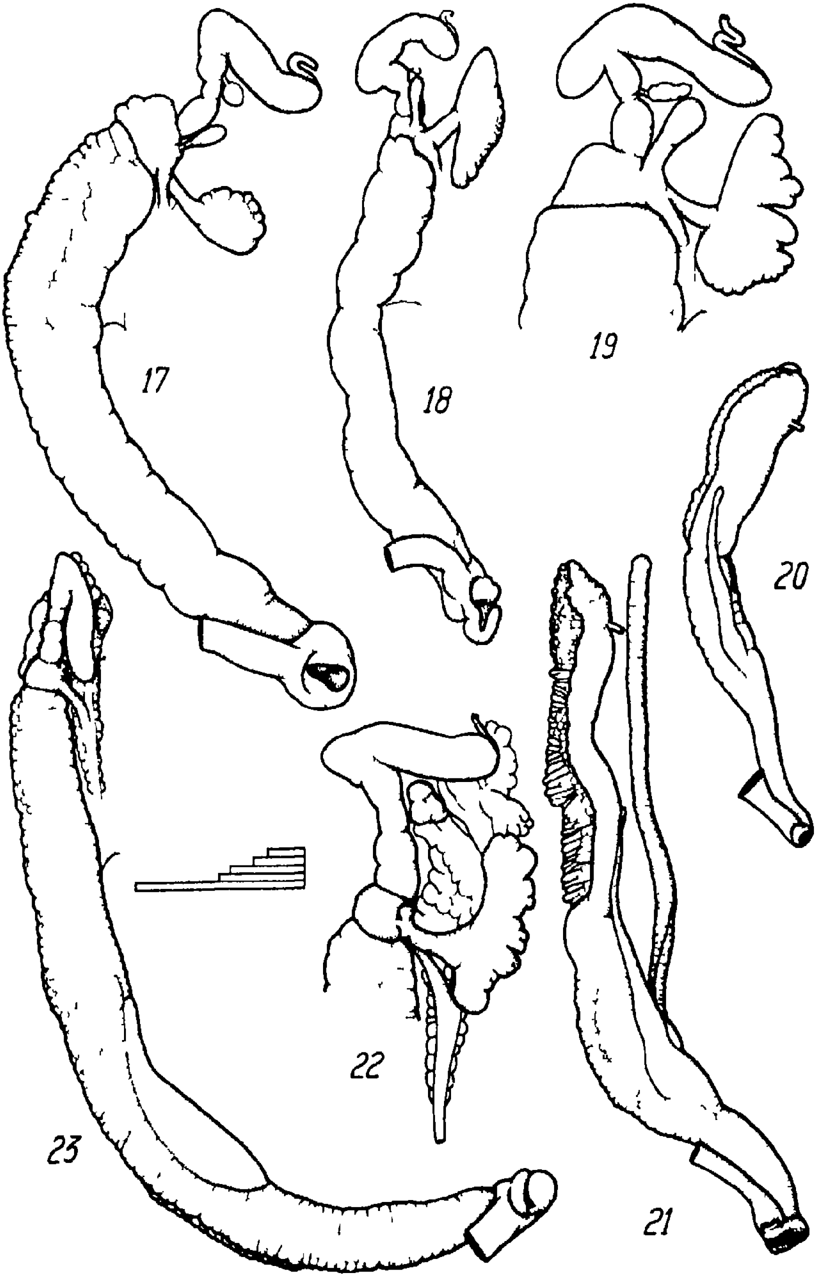

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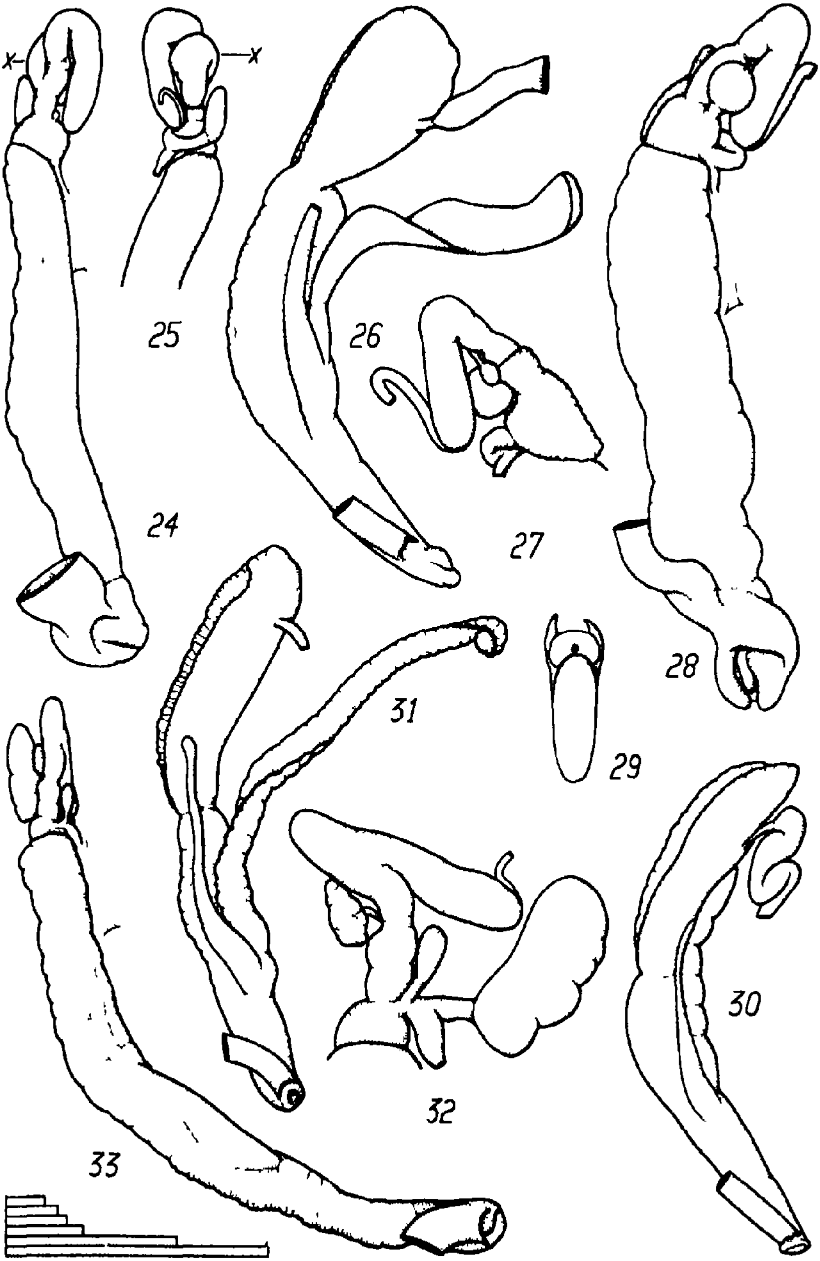

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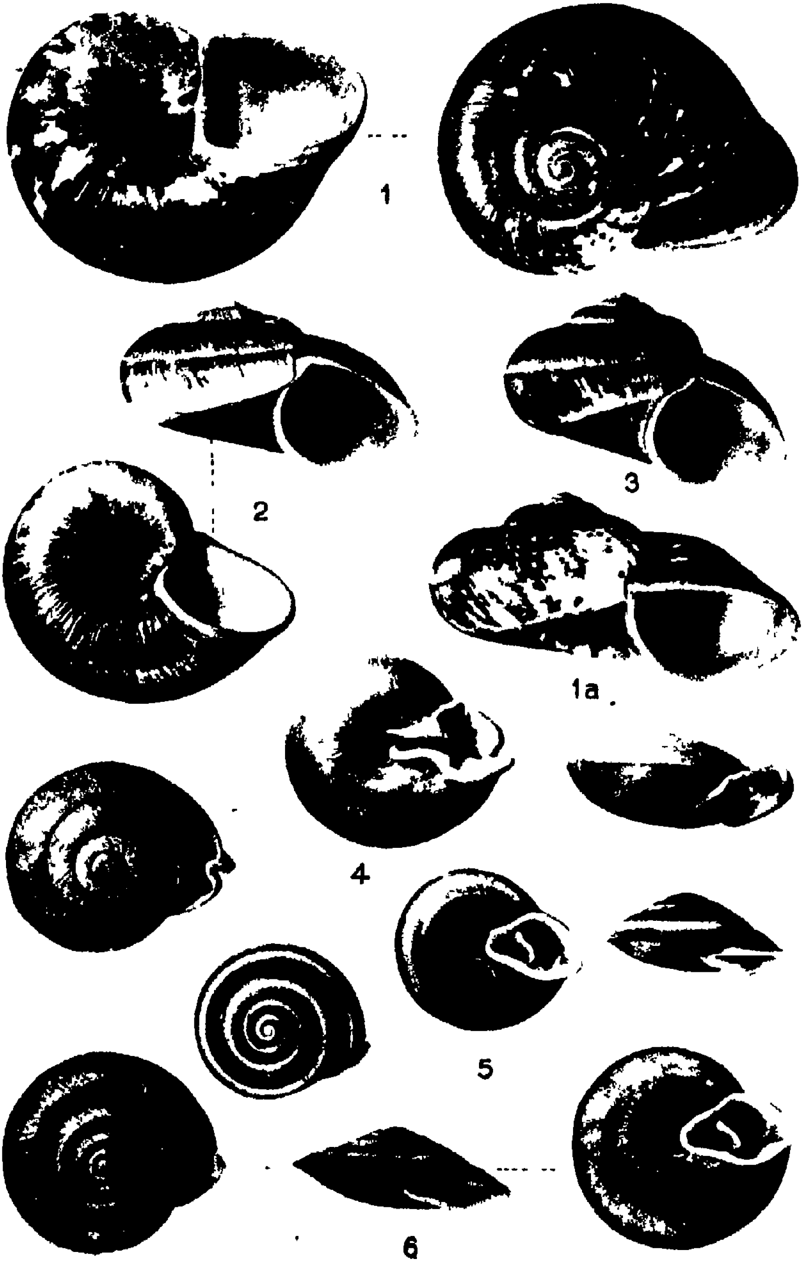

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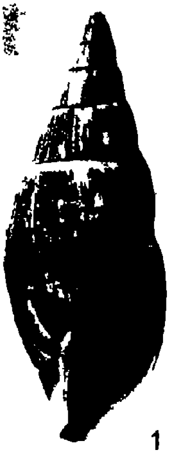

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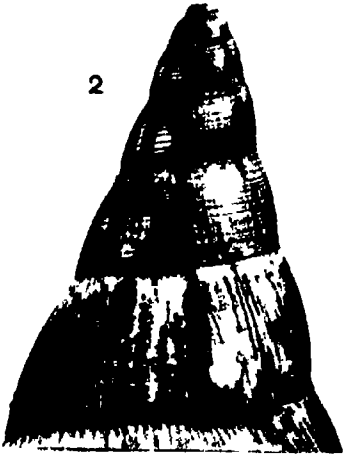

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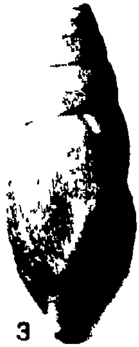

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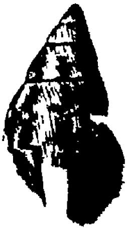

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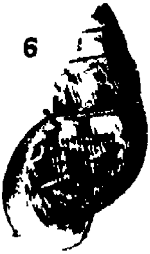

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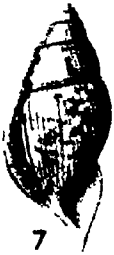

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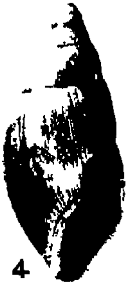

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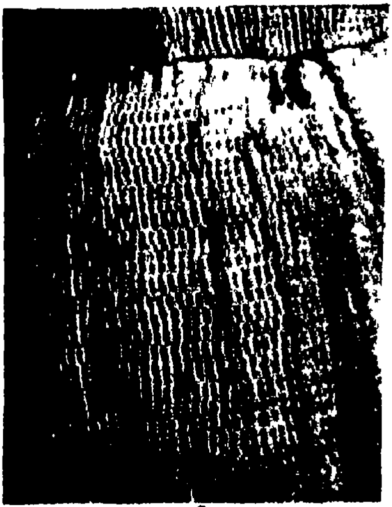

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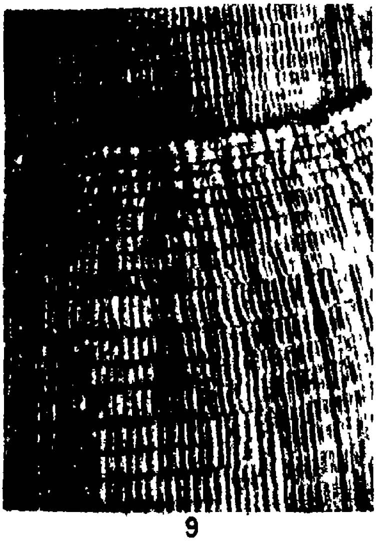

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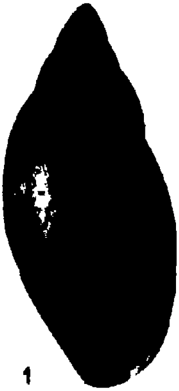

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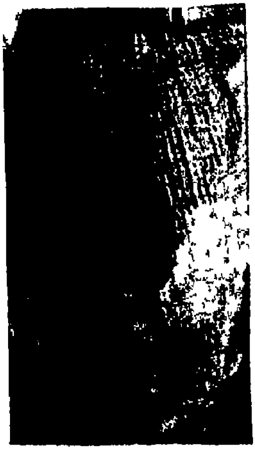

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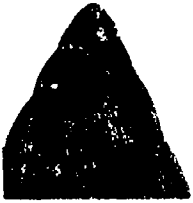

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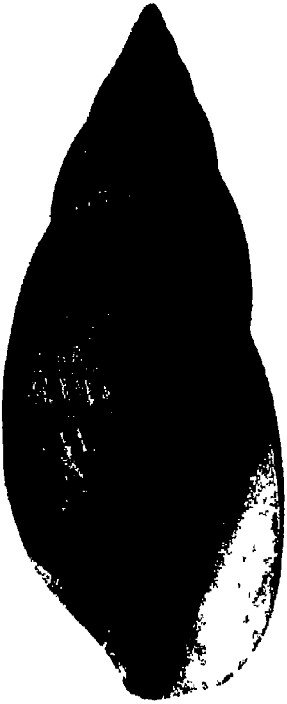

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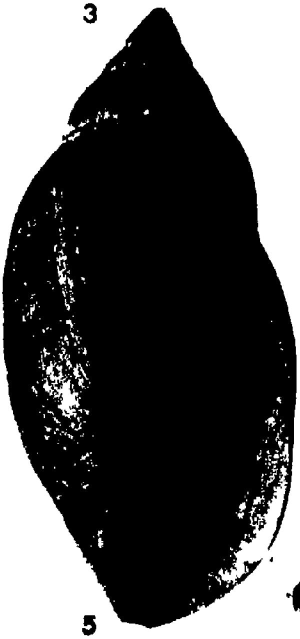

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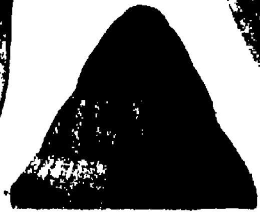

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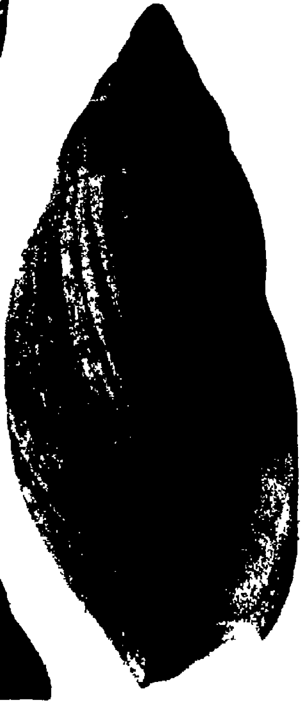

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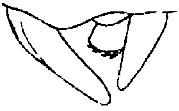

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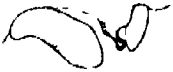

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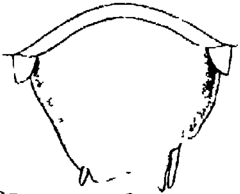

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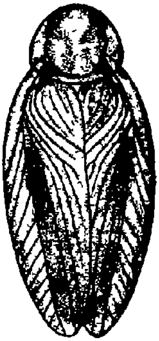

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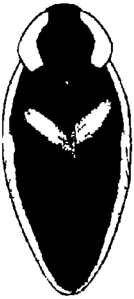

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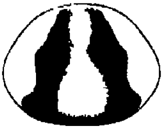

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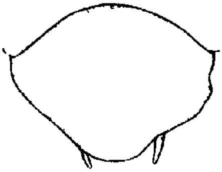

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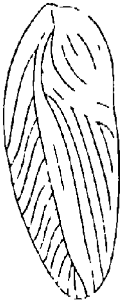

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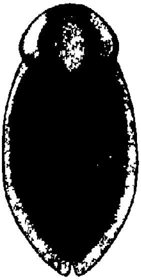

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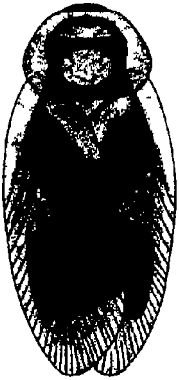

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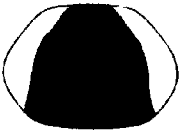

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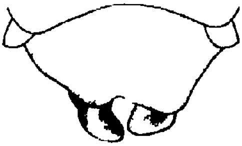

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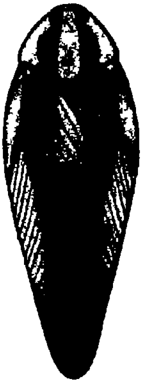

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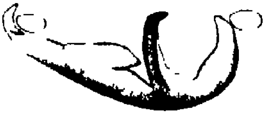

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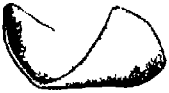

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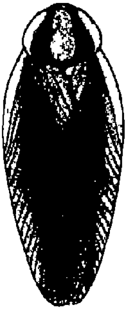

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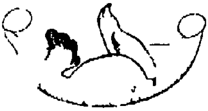

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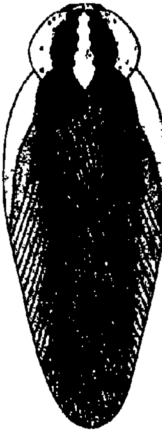

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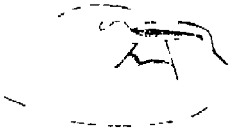

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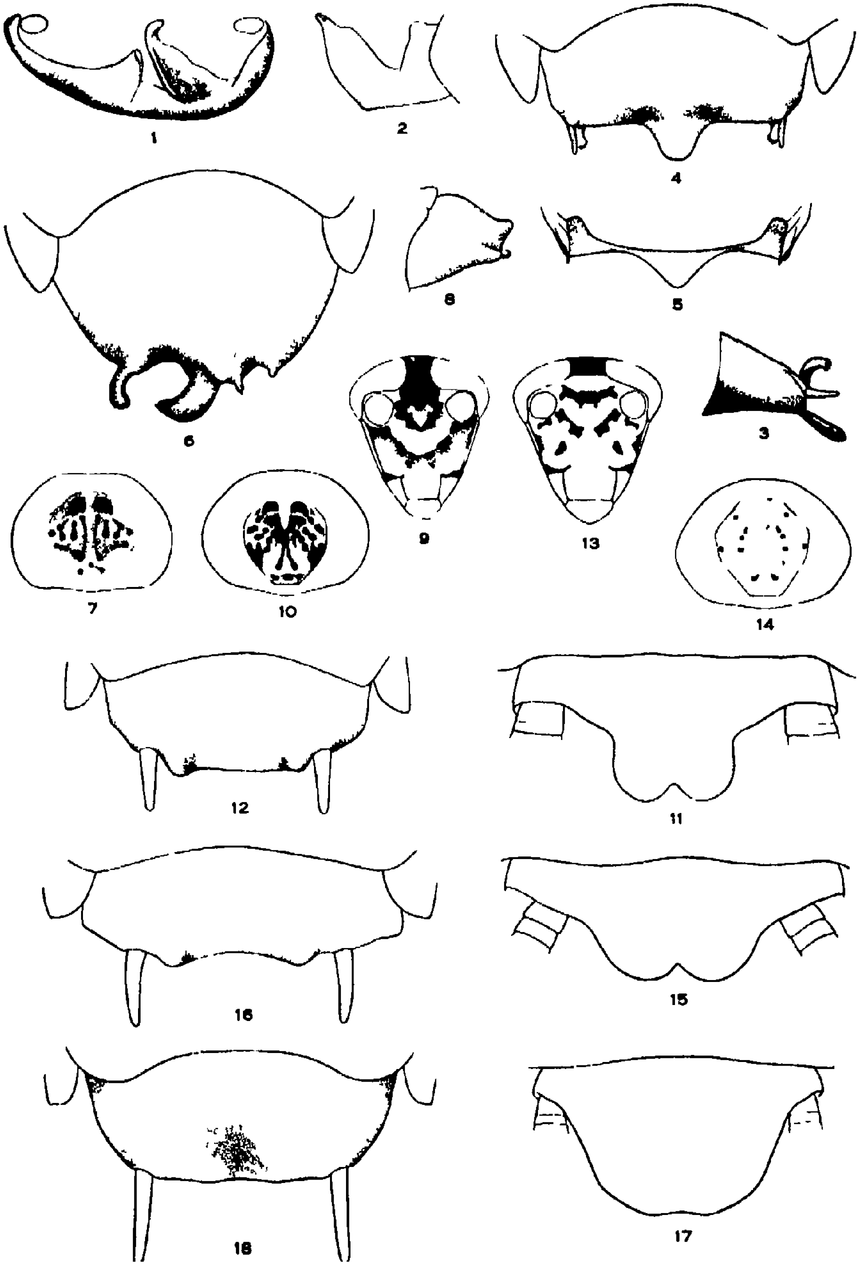
HEBARD BLATTIDAE OF FRENCH GUIANA



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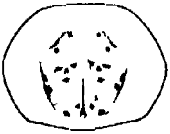
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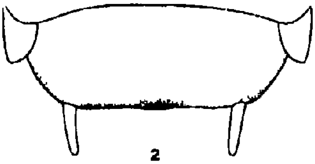
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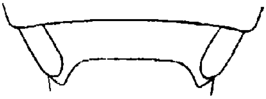
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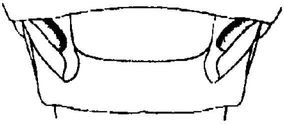
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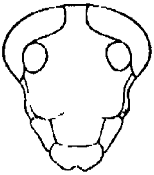
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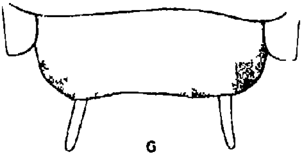
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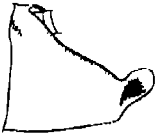
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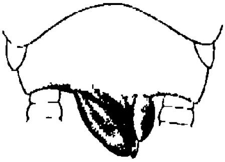
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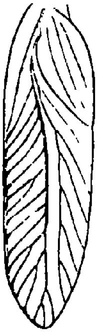
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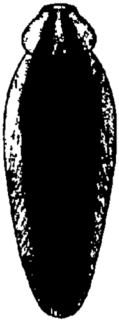
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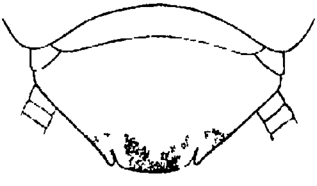
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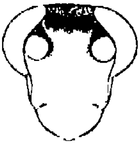
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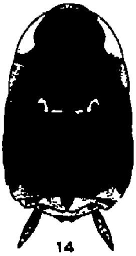
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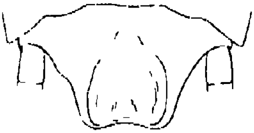
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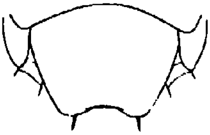
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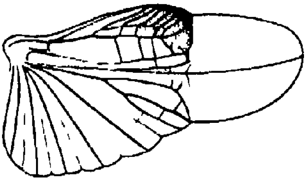
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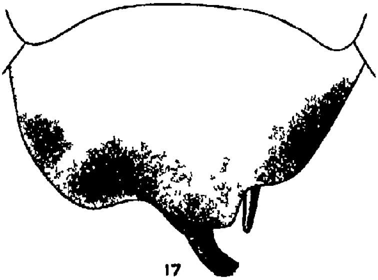
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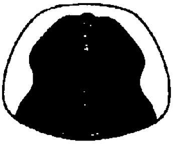
HEBARD: BLATTIDAE OF FRENCH GUIANA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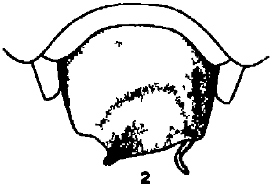
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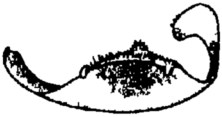
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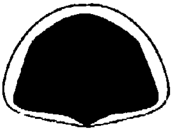
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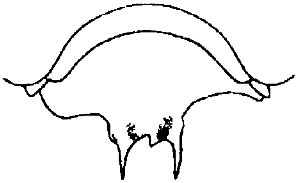
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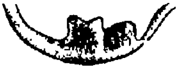
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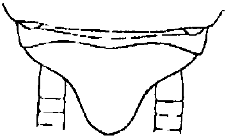
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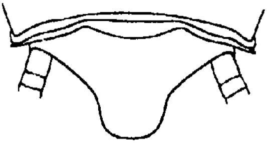
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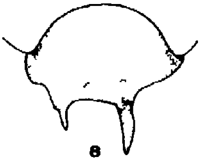
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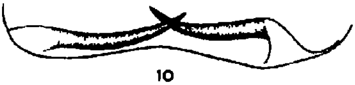
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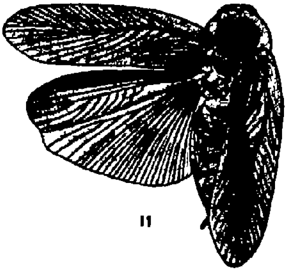
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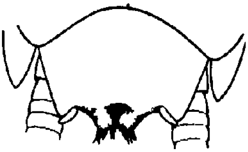
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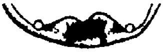
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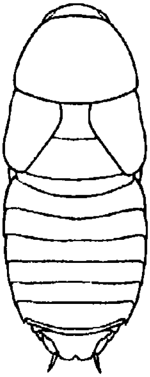
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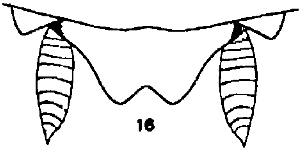
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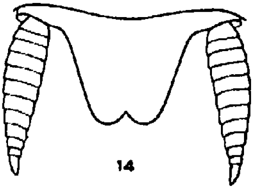
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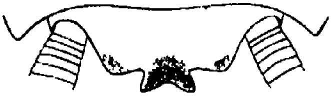
HEBARD: BLATTIDAE OF FRENCH GUIANA



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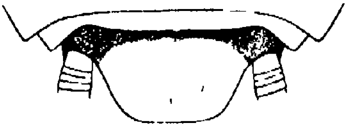

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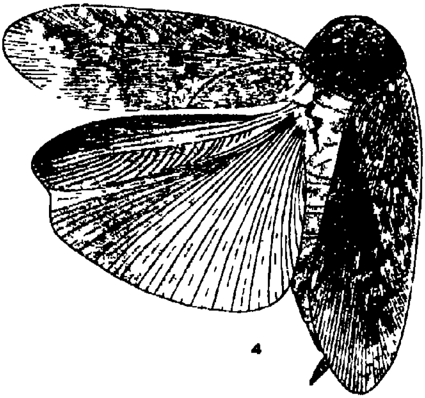

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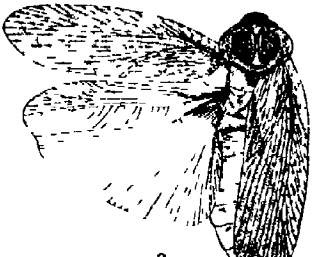

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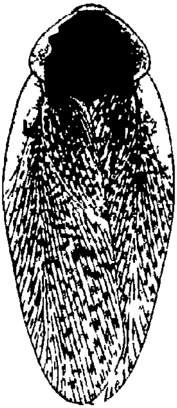

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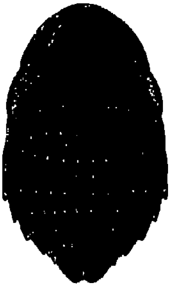

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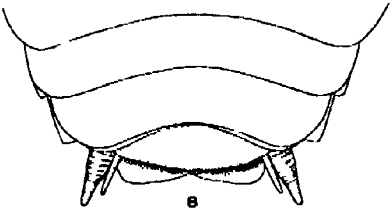

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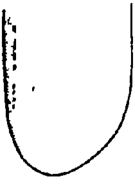

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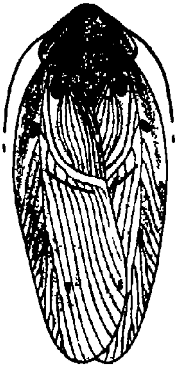

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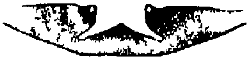

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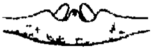

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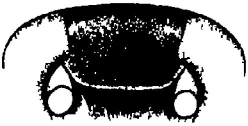

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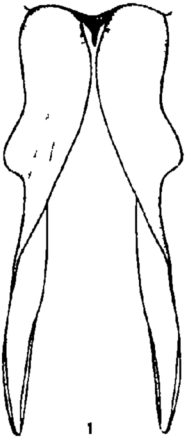
HEBARD BLATTIDAE OF FRENCH GUIANA



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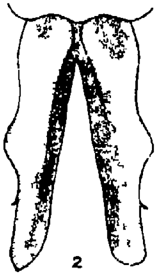

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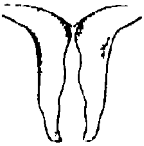

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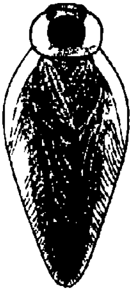

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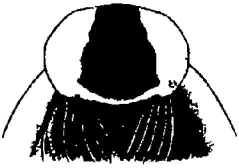

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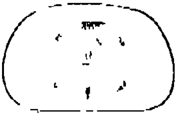

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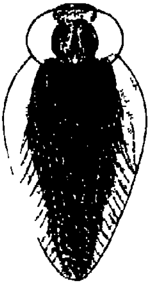

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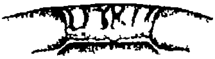

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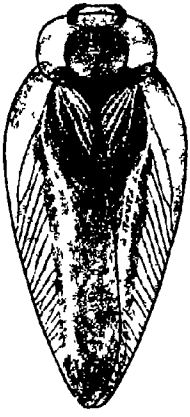

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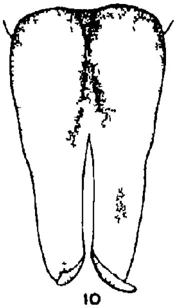

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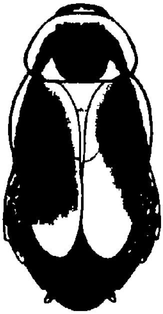

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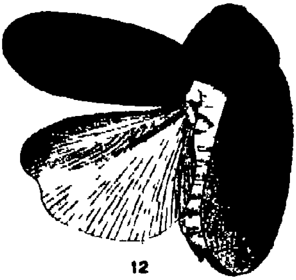

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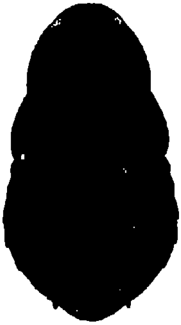

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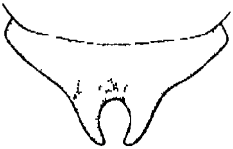

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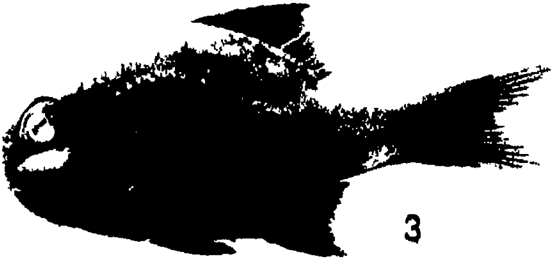
HEBARD BLATTIDAE OF FRENCH GUIANA

1

2



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SILVESTER AND FOWLER KRYPTOPHANARON ALFREDI

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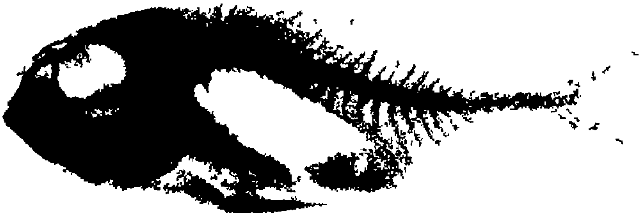

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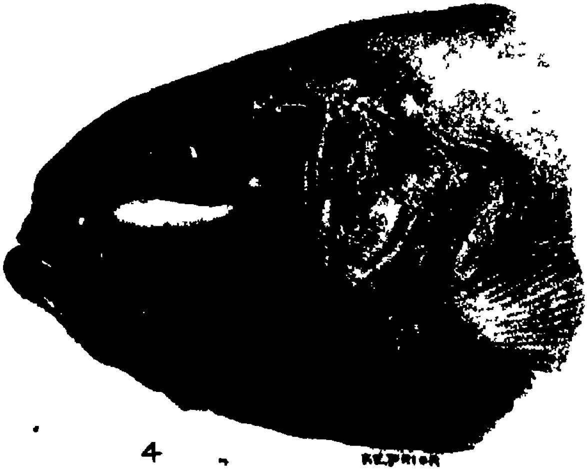

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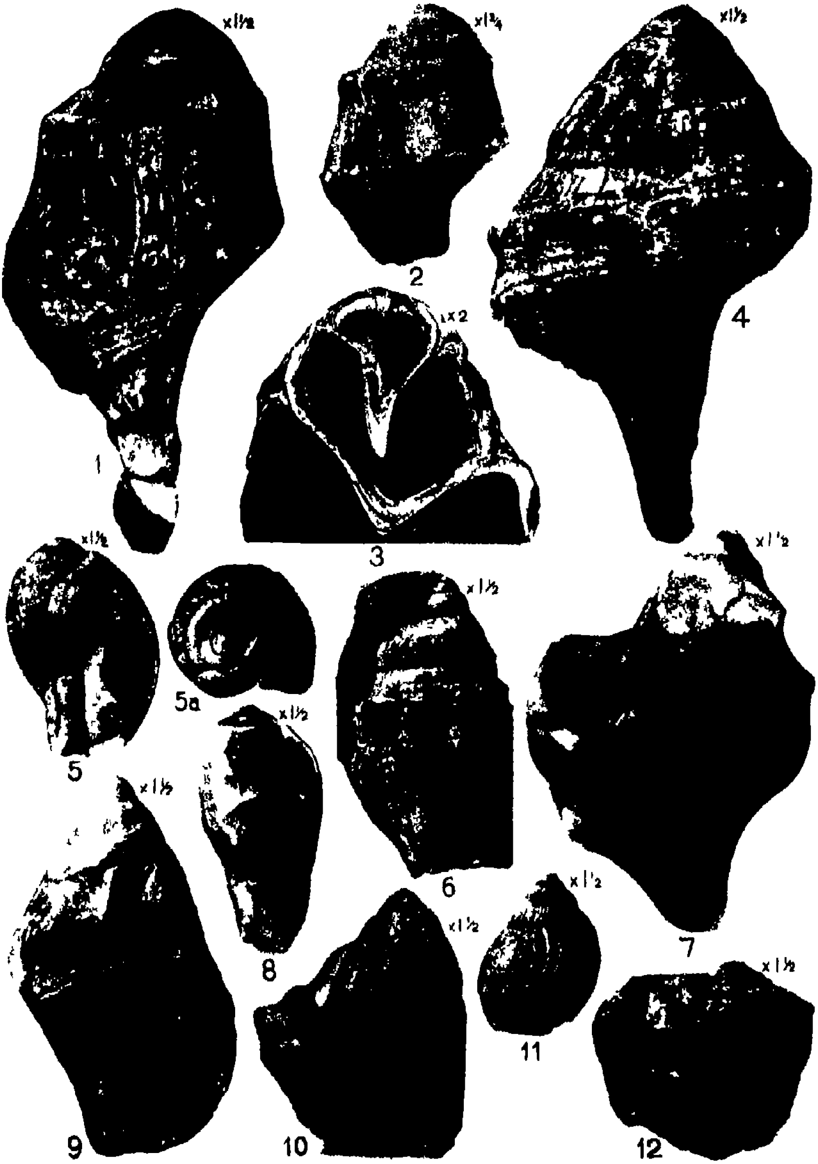
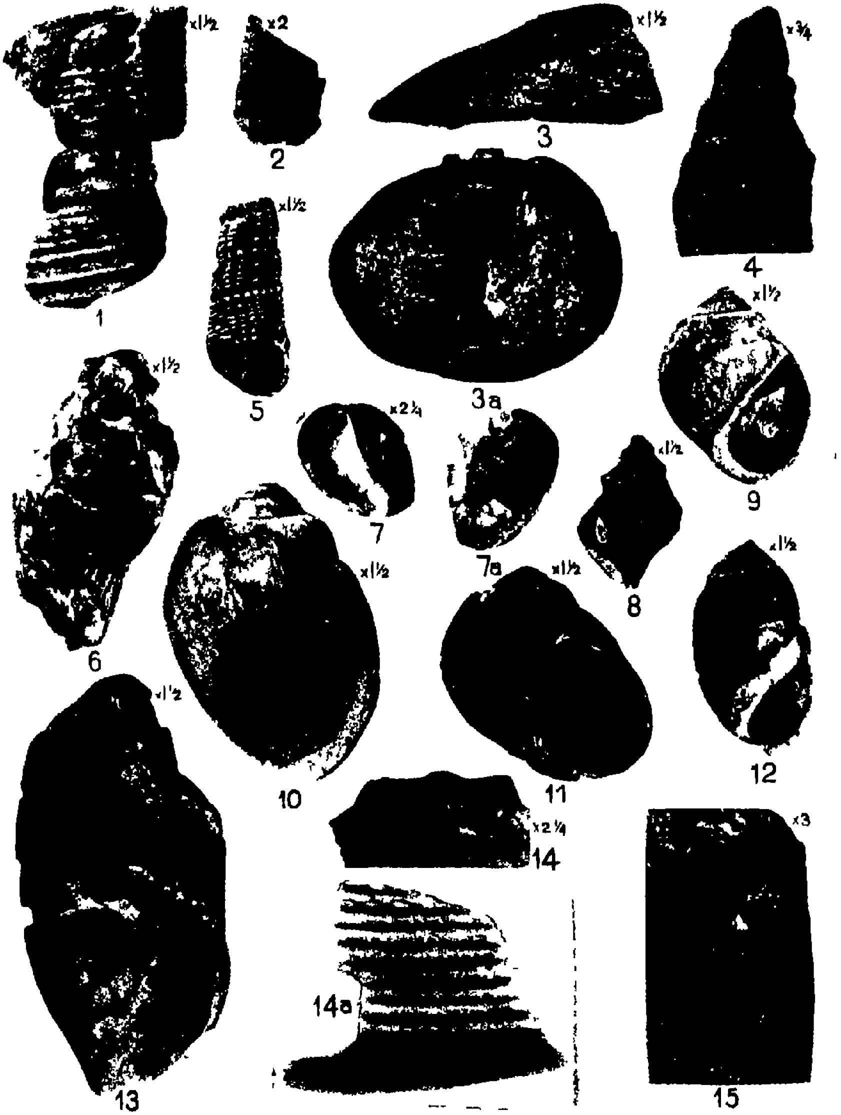
SILVESTER AND FOWLER: KRYPTOPHANARON ALFREDI



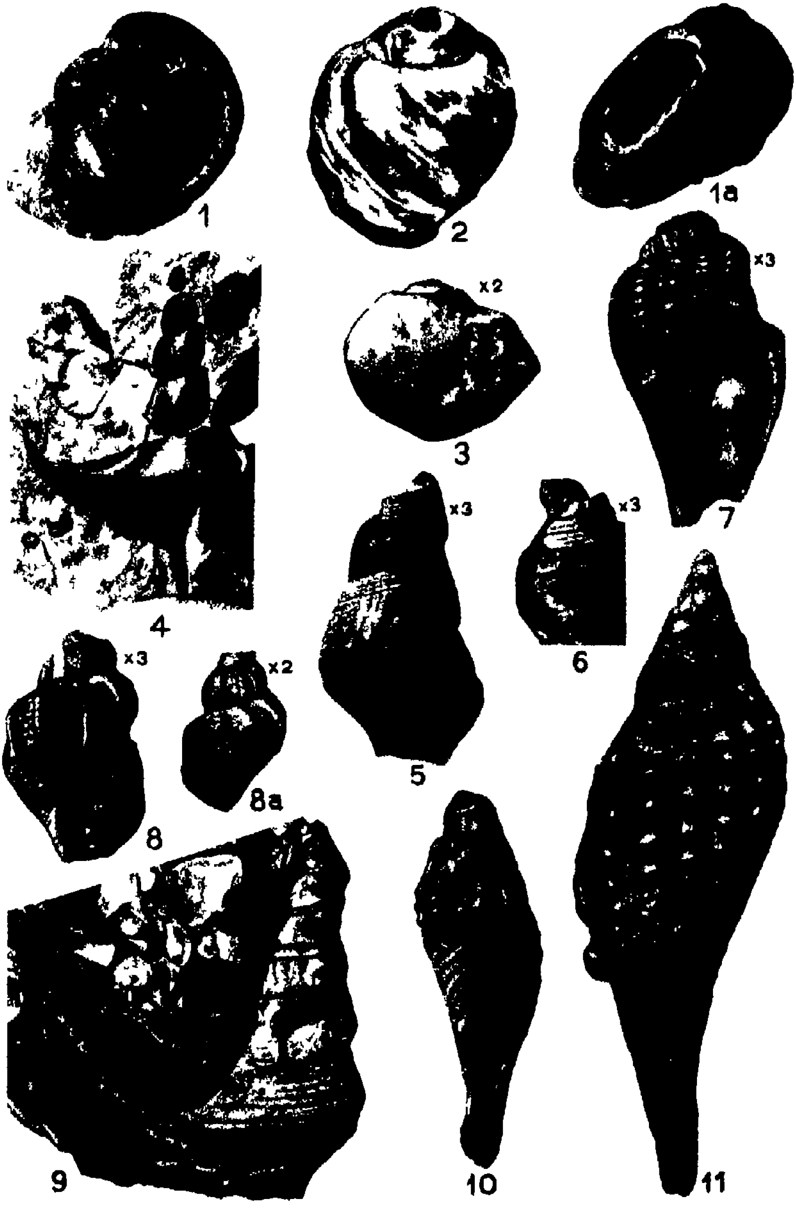
STEWART CALIFORNIA FOSSIL GASTROPODS

1-3 Cophocara stantoni
4 Perissitys brevirostris
5-5a Haydenia impressa
6-7 Conchothyra hamula
8 Sycodes cypraeoides
9 Empachya ponderosa
10-12 Pugnellus manubriatus



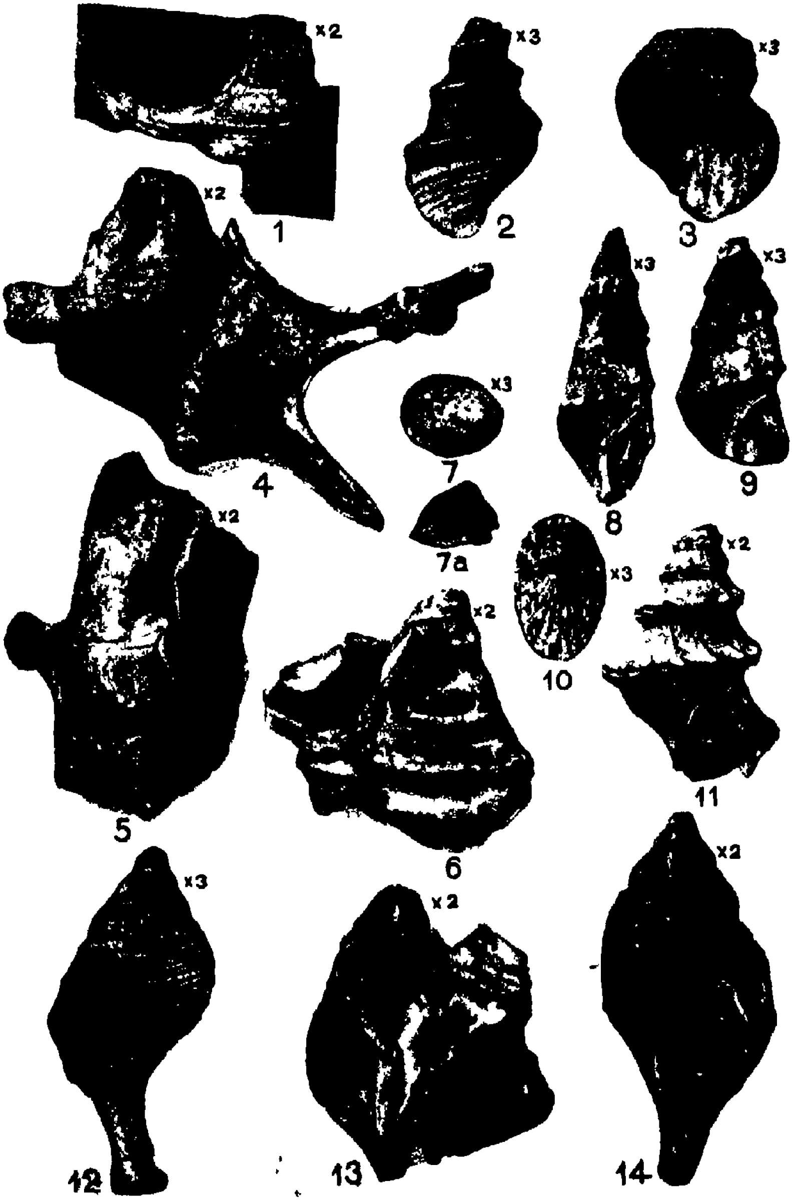
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Turritella chicoensis
2 Turritella seriatimgranulata
3-3a Velates cuneatus
4 Turritella ? robusta
5 Elimia veatchii
6 "Fusus" tumidus
7-7a Lysis duplicosta
8 Pseudoperissolax ? occidentalis
9 Ampullina avellana
10 Ampullina oviformis
11 Polinices shumardianus
12 "Acteonina" calafia
13 Acteonella oviformis
14 14a Architectonica ? veatchii
15 Arrhoges californicus



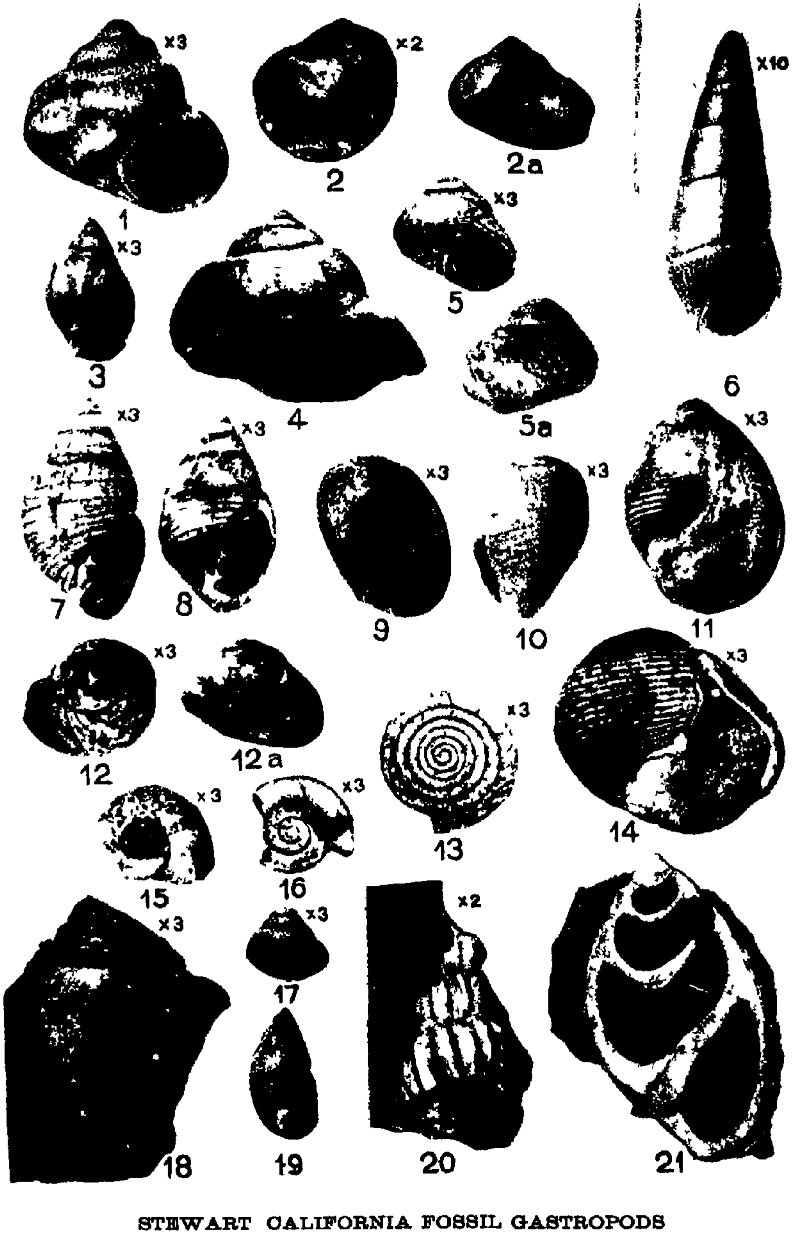
STEWART CALIFORNIA FOSSIL GASTROPODS

1–1a, 3 Gyrodes expansa 2 Gyrodes conradiana 4–5 Anchura ? angulata 6 "Anchura' carinifera 7 Volutoderma mitraeformis 8–8a Paladmete perforata 9 Anchura falciformis 10–11 Volutoderma averilli



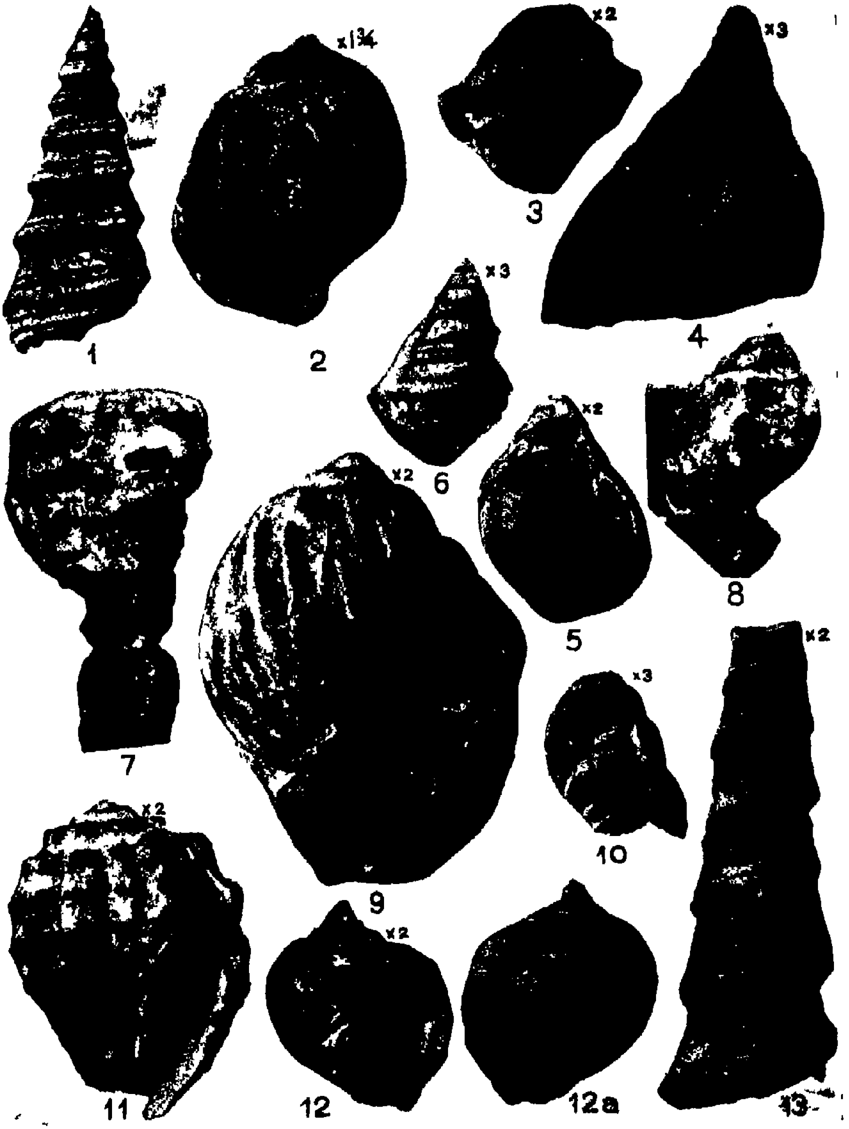
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Drepanochilus ? transversus 2 Tessarolax ? inconspicua 3 Atresius liratus 4 5 Tessarolax distorta 6 Tessarolax bicarinata 7-7a Hipponix dichotomus 8-9 Potamides tenuis 10 Emarginula gabbi 11 Potamides diadema 12-14 Plectorion curvirostris.



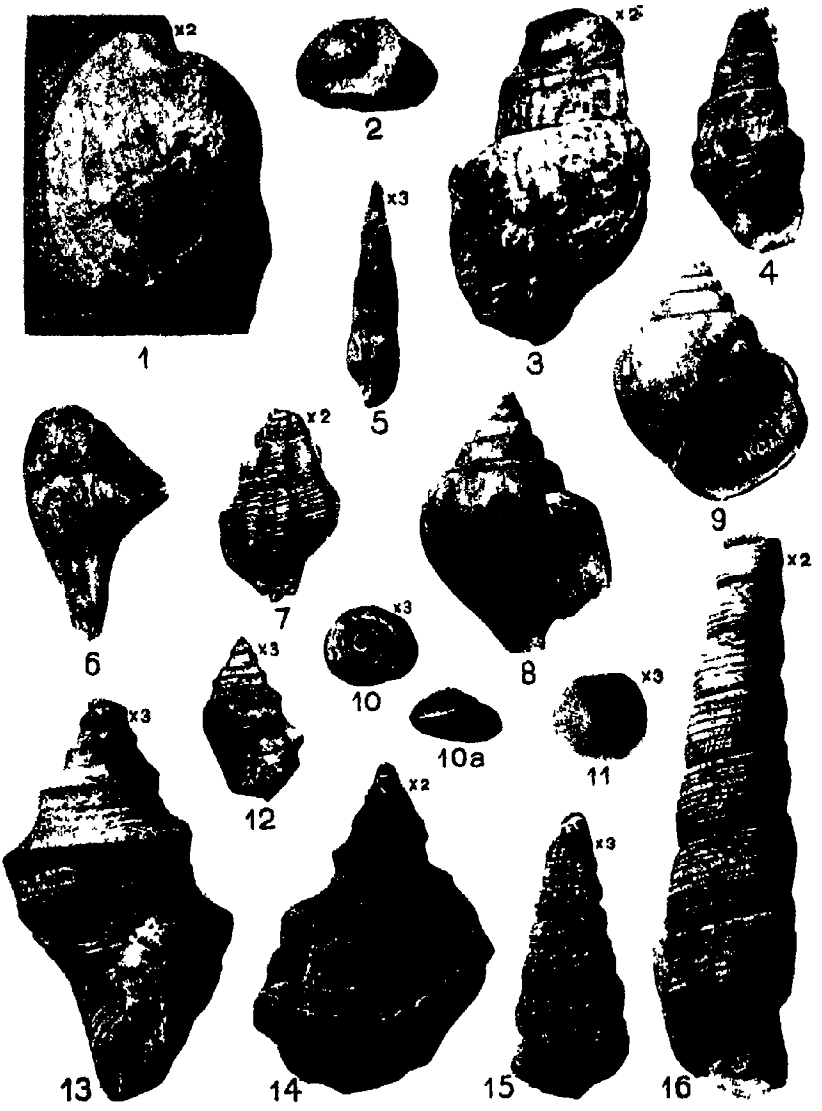
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Margarites ornatissimus 2–2a, 4 Margarites inornatus 3 "Ringicula" varia 5–5a Ataphrus compactus 6 Liocium punctatum 7–8 Tornatellaea impressa 9–10 Noetca gabbi 11 Avellana mathewsonii 12–12a Ataphrus crassus 13 Ventridens lens 14 Oligoptycha obliqua 15 "Straparollus" paucivolvus 16 "Discohelix" leana 17 Solariella angulata 18–19 Acteon politus 20 Epitonium mathewsonii 21 "Acteonina" californica



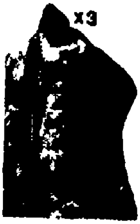
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Mesalia martinezensis
2 Brachsphingus sinuatus
3 Heteroterma trochoidea
4 5 Sycum mucronatum
6 Araeodactylus ? costatus
7 Priscoficus caudatus
8 "Neptunea" cretacea
9 Brachysphingus gabbi
10 Tornatellaea pinguis
11 Retipirula crassitesta
12-12a Lacunaria striata
13 Turritella infragranulata



STEWART CALIFORNIA FOSSIL GASTROPODS

1–2 Megistostoma gabbianum
3–4 Loxotrema turritum
5 Terebra californica
6 "Fasciolaria" laeviuscula
7 Whitneyella martinez
8–9 Amaurellina clarki
10–10a Solariella ? crenulata
11 Discinisca circularis
12–14 Surculites mathewsonii
15 Cerithium dumblei
16 Turritella uvasana, subsp



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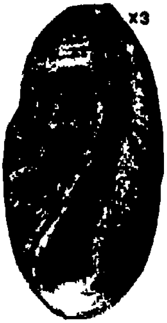

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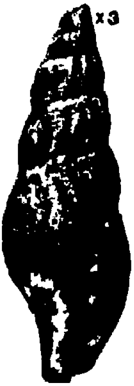

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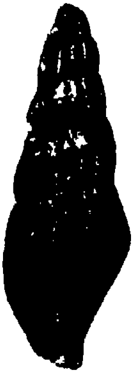

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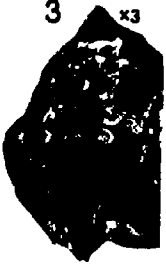

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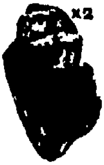

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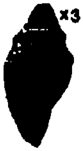

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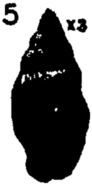

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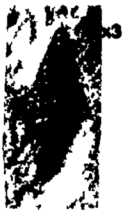

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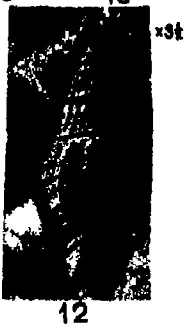

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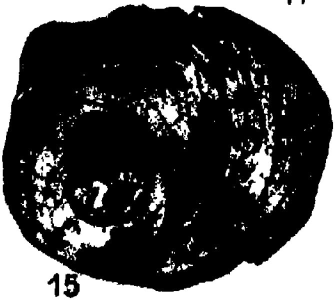

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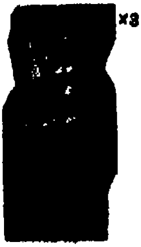
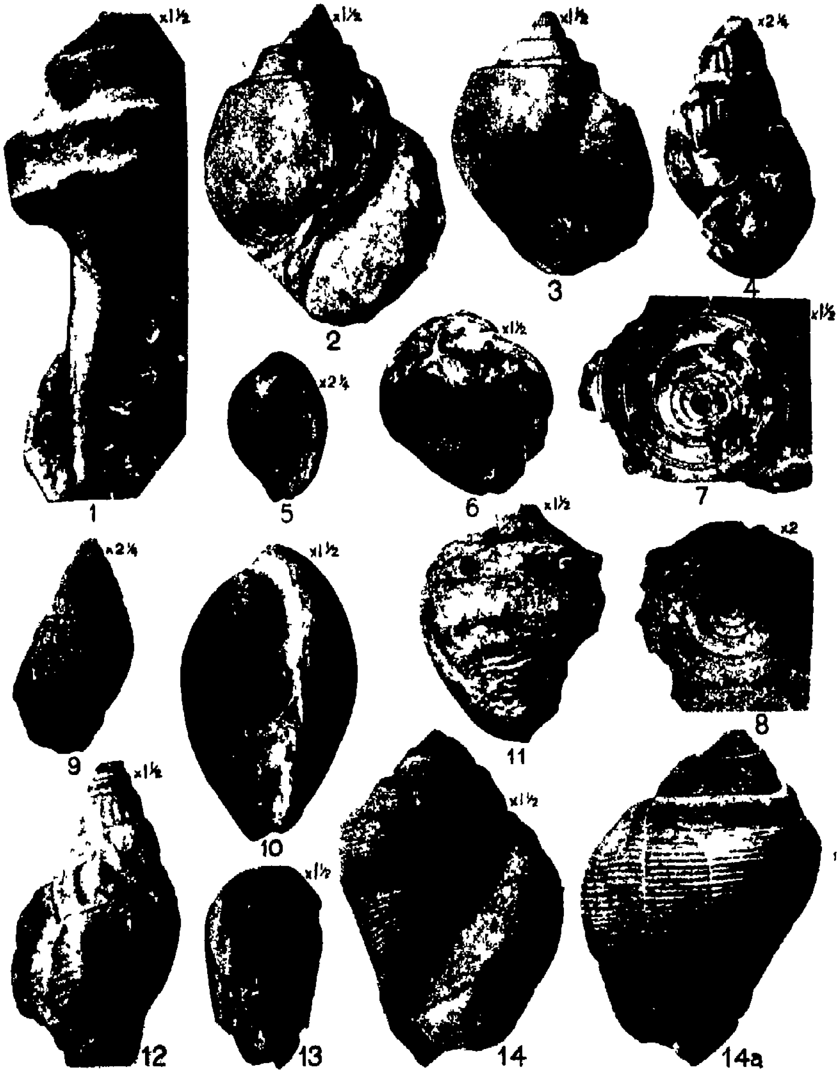


14

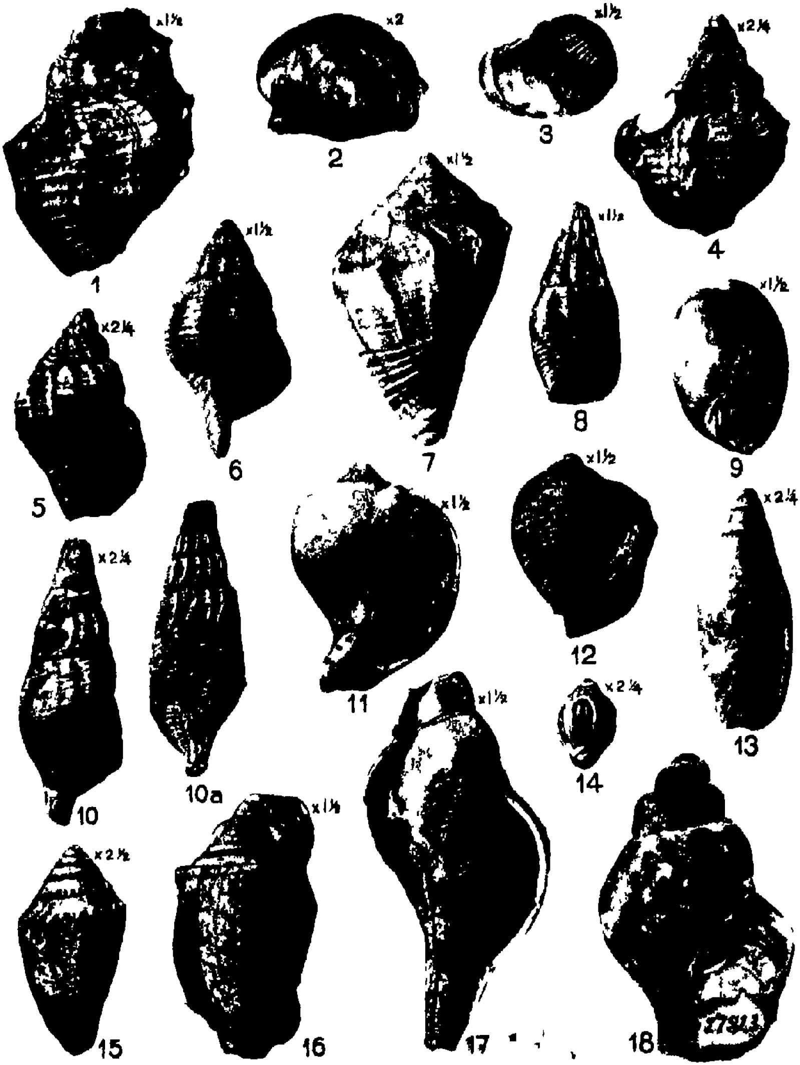
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Niso polita
2–4 Cylichnina tantilla
5 Scaphander costatus
6–6a Exilia diaboli
7–8 Typhis antiquus
9–10 Mitra cretacea
11–12 Scobinella claytonensis
13–14 Pleurofusia raricostata
15 Calyptraea diegoana



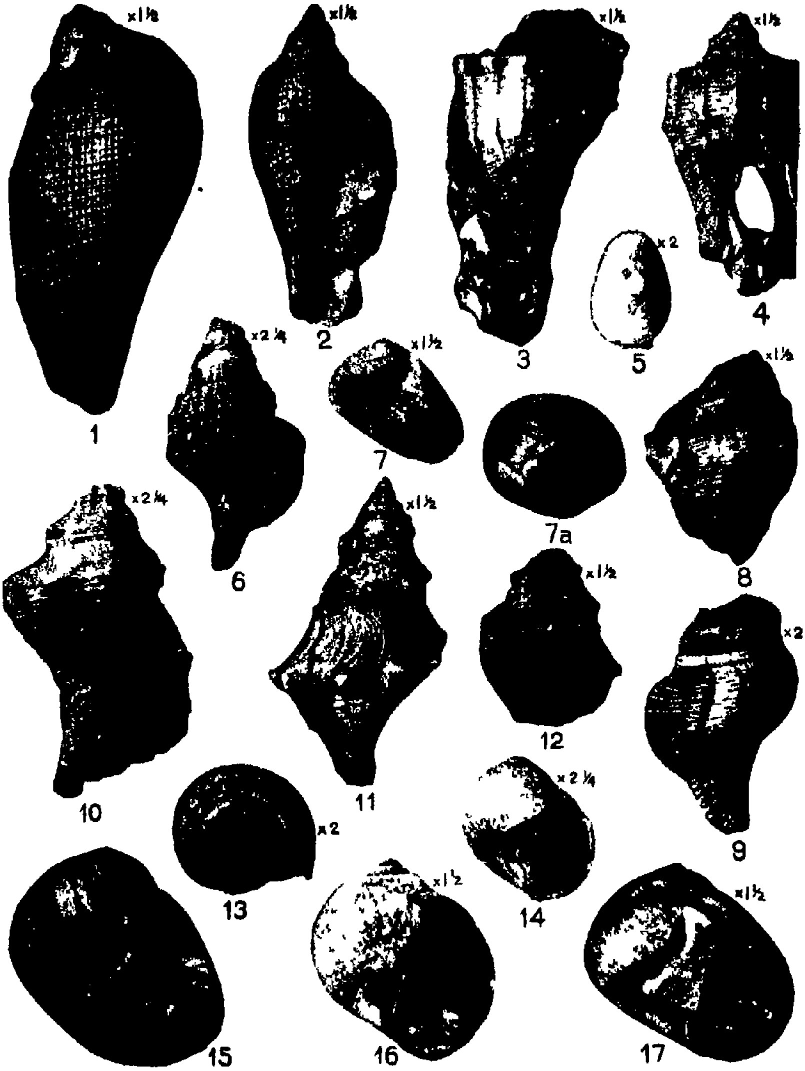
STEWART CALIFORNIA FOSSIL GASTROPODS

1 Pseudoperissolax blakei, subsp
2 Amaurellina moragai lajollaensis
3 Amaurellina moragai
4 Molopophorus antiquatus
5 Cypraea mathewsonii
6 Neverita globosa
7–8 Architectonica cognata
9 Molopophorus cretaceus
10 Cypraea castacensis
11 Galeodea tuberculiformis
12 Ectinochilus canalifer supraplicatus
13 Cypraea mathewsonii ?
14 Pseudoliva lineata



STEWART CALIFORNIA FOSSIL GASTROPODS

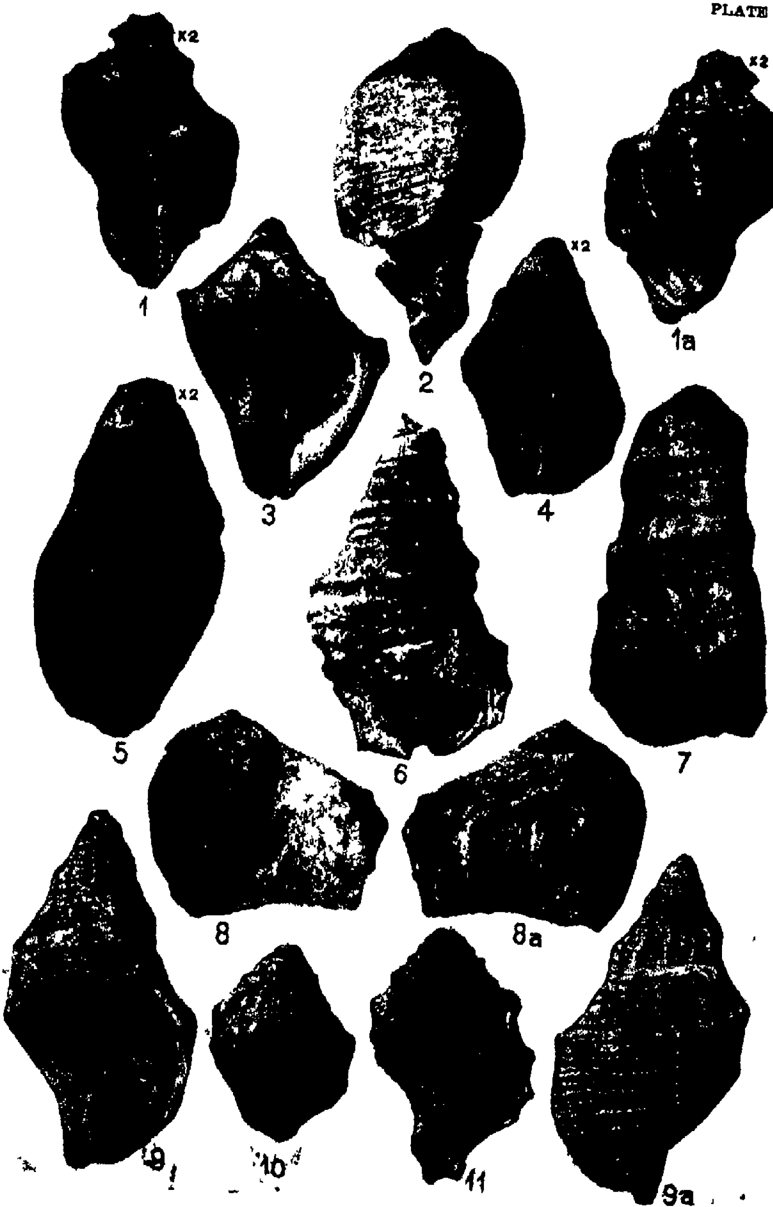
1, 4, 18 Olequahia hornii
2-3 Crepidula pileum
5 Bonellitia paucivaricata
6, 17 Whitneyella sinuata
7 Pseudoliva volutaeformis
8 Ectinochilus canalifer
9 Abderospira hornii
10-10a Exilia microptygma
11 Strepsidura ficus
12 Ficus mamillatus
13 Olivella mathewsonii
14 Molopophorus striatus
15 Conus remondii
16 Conus hornii



STEWART CALIFORNIA FOSSIL GASTROPODS

1–2 Ficopsis remondii
3–4 Ficopsis hornii
5 Acmaea tejonensis
6 Gyrineum californicum
7–7a Sinum obliquum
8–9 Ranellina pilsbryi
10 Murex whitneyi
11 Nekewis io
12 Surculites sinuatus
13 Architectonica hornii
14 Natica uvasana
15 Polinices hornii
16 Euspira nuciformis
17 Neverita secta

PLATE XXXI



STEWART CALIFORNIA FOSSIL GASTROPODS

1–1a Cancellaria vetusta 2 Ficus modestus 3 Thais ponderosa 4 Molopophorus biplicatus 5 Pseudotoma remondii 6 Neptunea altispira 7 Turritella mezana 8, 8a Ficus oregonensis. 9–9a Cancellaria altispira 10–11 Bruclarkia gravida

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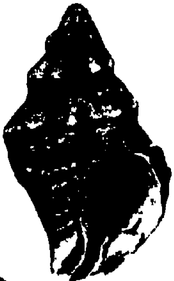

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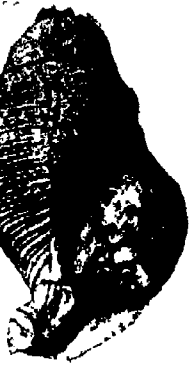

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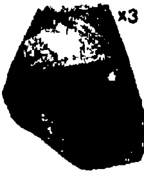

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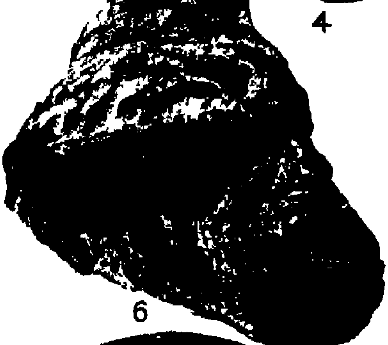

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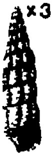

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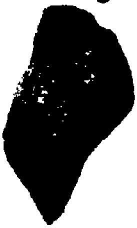

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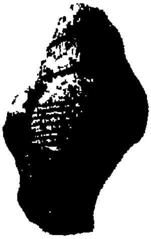

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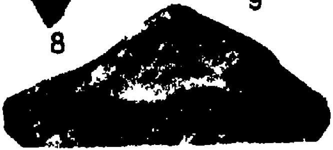

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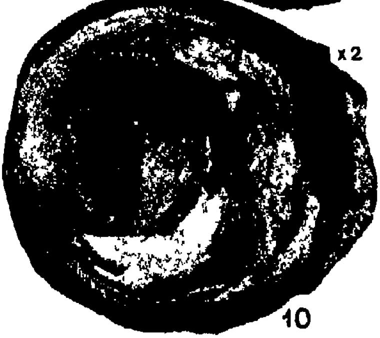

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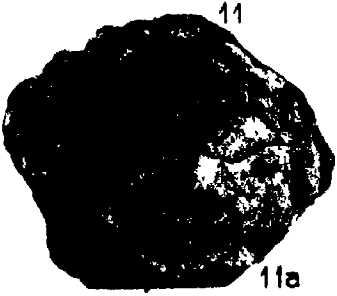
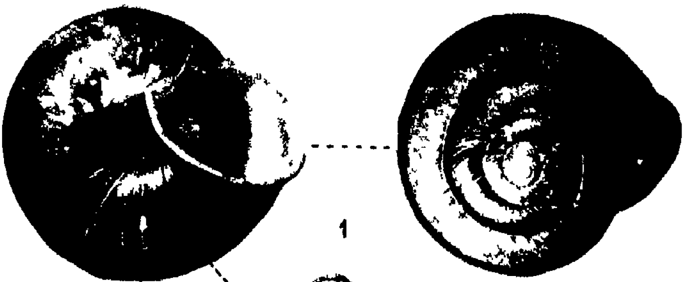


11a

STEWART CALIFORNIA FOSSIL GASTROPODS

1 Purpura monoceros
2–3 Neptunea humerosa
4 Sinum scopulosum
5 Littorina remondii
6 Astraea biangulata
7 Bittium asperum
8–9 Colus recurvus
10 Calyptraea mamillaris
11–11a Acmaea rudis



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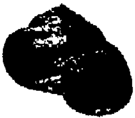

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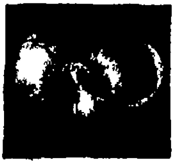

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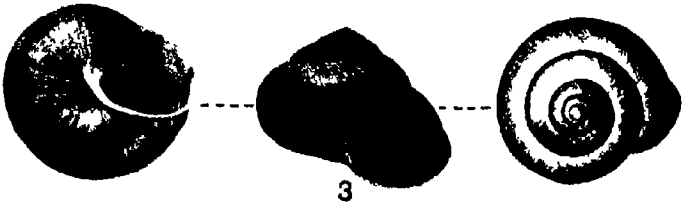

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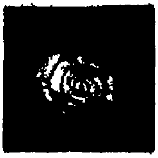

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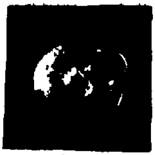

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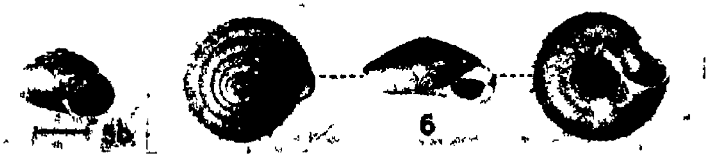

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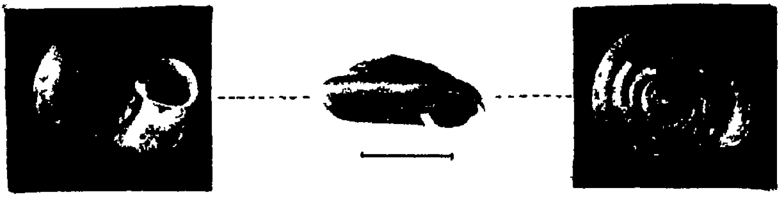
PILSBRY LAND MOLLUSCA OF KOREA



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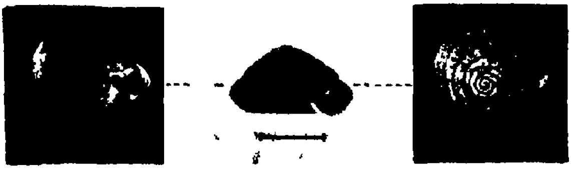

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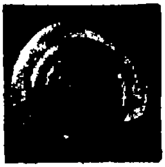

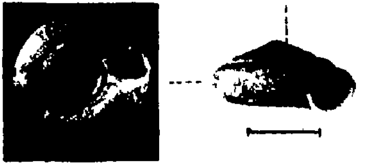

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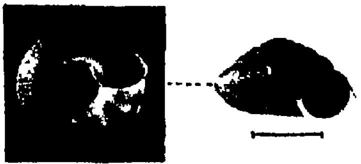

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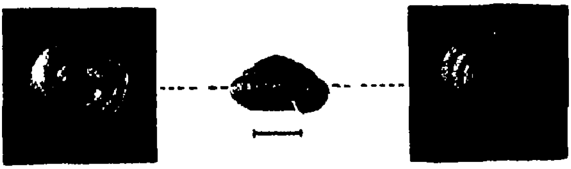

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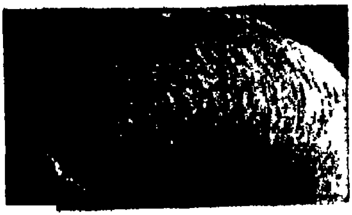

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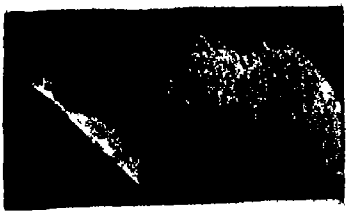

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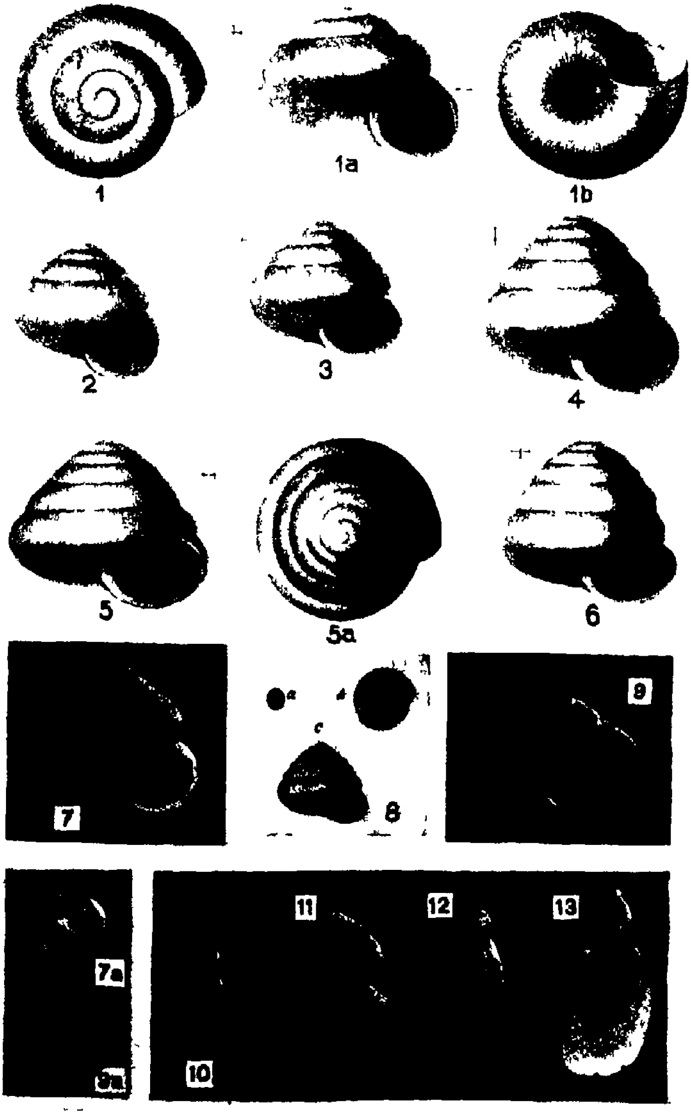

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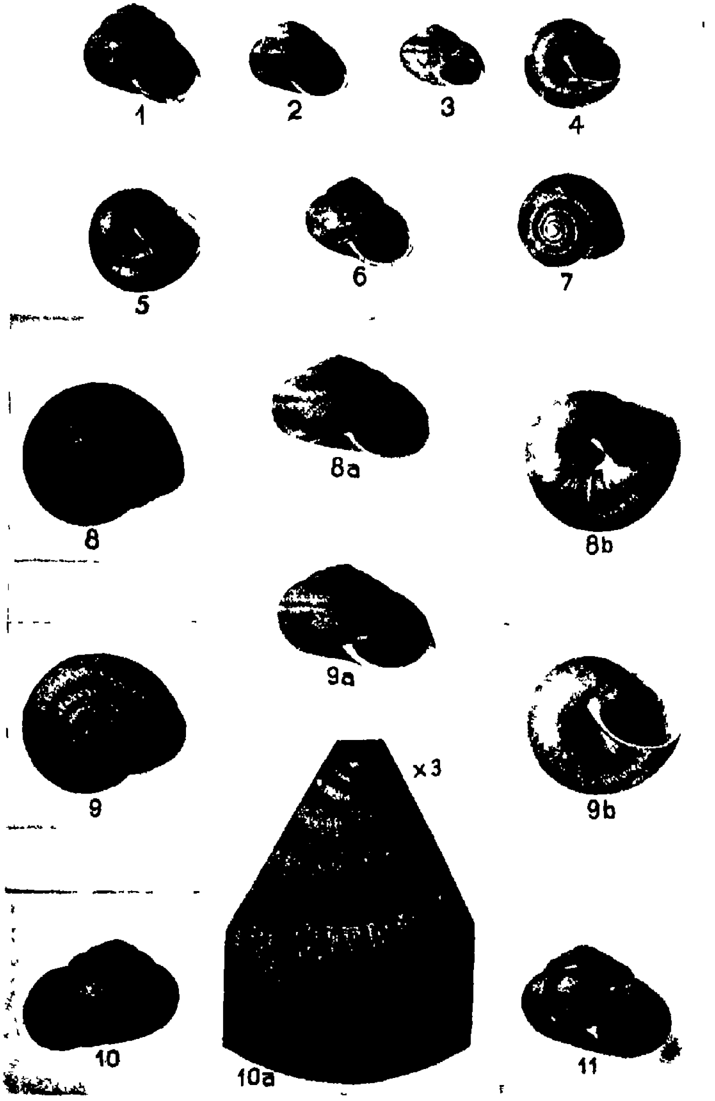
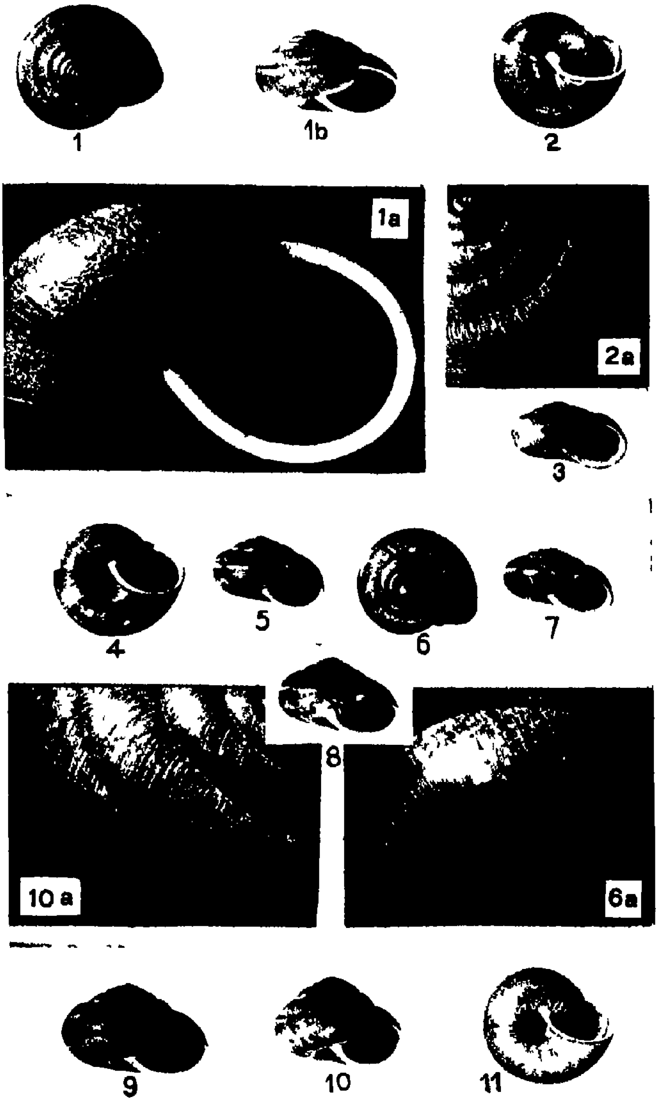


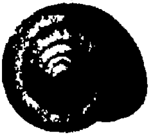
PILSBRY LAND MOLLUSKS FROM CENTRAL AND NORTHERN CALIFORNIA

1-4 Helminthoglypta nickliniana awania 5-7 Helminthoglypta nickliniana, small form
8-11 Helminthoglypta nickliniana anachoreta



PILSBRY LAND MOLLUSKS FROM CENTRAL AND NORTHERN CALIFORNIA

1–2*a* Helminthoglypta diabloensis 3–11 Helminthoglypta contracostae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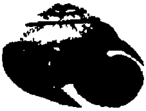
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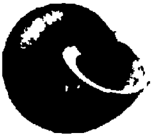
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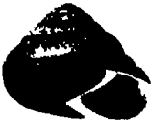
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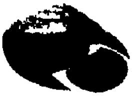
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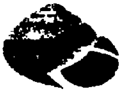
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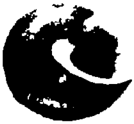
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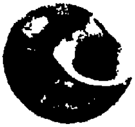
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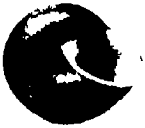
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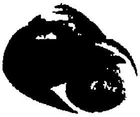
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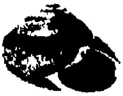
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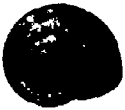
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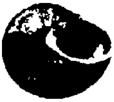
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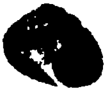
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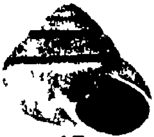
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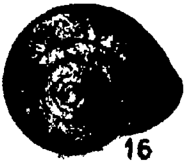
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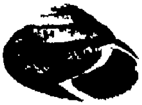
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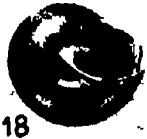
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PILSBRY: LAND MOLLUSKS FROM CENTRAL AND NORTHERN CALIFORNIA

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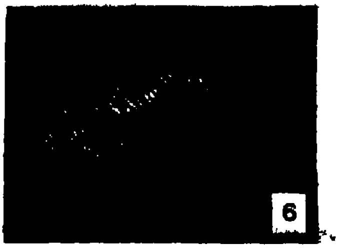
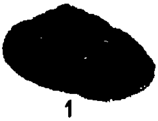
4–9 H arrosa miwoka
10–15 H arrosa mailliardi
16–18. H arrosa stiversiana.



PILSBRY: LAND MOLLUSKS FROM CENTRAL AND NORTHERN CALIFORNIA

1. Helminthoglypta arrosa marinensis
2, 4. H. a. stiversiana
3. H. a. miwoka
5, 6. H. tudiculata cypreophila.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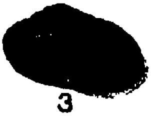
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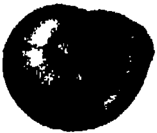
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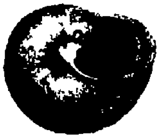
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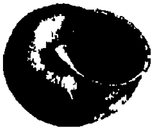
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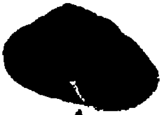
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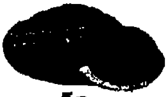
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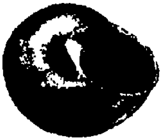
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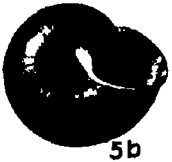
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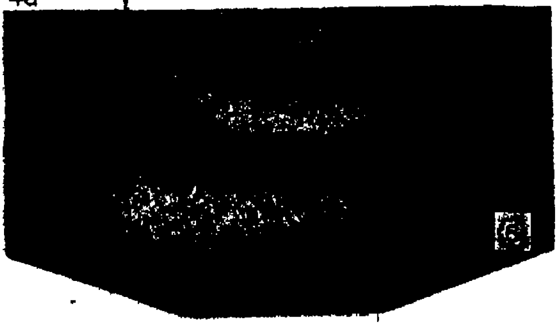
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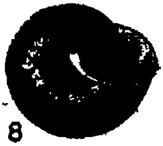
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PILSBRY LAND MOLLUSKS FROM CENTRAL AND NORTHERN CALIFORNIA

1–4*a* Helminthoglypta tudiculata cypreophila.
5–5*b* Monadenia mormonum loweana
6–8. Monadenia mormonum hirsuta.

PROCEEDINGS

OF

The Academy of Natural Sciences

OF

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VOLUME LXXVIII
1926
SUPPLEMENT

SYNOPSIS OF NORTH AMERICAN DIATOMACEAE

PART I.—COSCINODISCATAE, RHIZOSELENATAE, BIDDULPHIATAE, FRAGILARIATAE

BY

CHARLES S. BOYER, A M., F.R.M.S.

PHILADELPHIA
THE ACADEMY OF NATURAL SCIENCES
1927

To

T. CHALKLEY PALMER, F.R.M S,

PRESIDENT OF THE ACADEMY OF NATURAL SCIENCES

BECAUSE OF HIS INTEREST IN THE SUBJECT AND HIS KNOWLEDGE
OF IT, THIS WORK IS DEDICATED AS A TOKEN
OF ESTEEM BY THE AUTHOR.

DIATOMACEAE

Microscopic organisms, unicellular and free or sessile, or united in filaments, sometimes immersed in a gelatinous envelope or contained in tubes, either simple or branched Cell wall more or less siliceous, composed of two parts or valves, usually connected by a zone or girdle, and forming what is known as the frustule which is surrounded by a thin stratum known as the coleoderm The cell-contents, as distinguished from those of other organisms, include yellowish or brownish chlorophyll-like bodies, chromatophores, which occur in one or several bands (placcochromatic), or as variously distributed granular masses (coccochromatic), usually lining the inner walls Growth by ordinary cell division or by auxospores, sexual multiplication by the formation of sporangia

MORPHOLOGY

Macroscopic Appearance

Color When in pure mucous masses upon algae or other water plants the color of the colonies, due to the great amount of coleoderm, is almost absent, the mucus appearing hyaline In general, however, the thin strata assume a yellowish tint, due to the endochrome, and, in proportion to the mass, become darker, yellowish brown, brown, and, in larger masses, often chocolate or nearly black A few exceptions have a greenish or bluish tint The color is variously modified by impurities but when dry the pure deposits are white

Size. The size of the colonies varies from minute patches upon rocks and plants to filaments two or more feet in length, or spread out in floating masses variable in size, upon streams and ponds or accumulated in hot springs. In marine forms vast floating or partly submerged masses occur, and, in polar regions, in strata hundreds of feet in depth and sometimes extending for many miles

Mode of Growth Many marine and fresh water species are connected by their valve surface in filaments, variable in length, which may be attached by stipes to rocks or algae Others are found either single or in branched or umbellate clusters or stipes, or in bundles, or sessile upon rocks, shells and plants. Certain forms are in amorphous masses or enclosed in mucous tubes, while many are epiphytic and some appear to be parasitic on other diatoms Frustules are more often found free, however, especially those with a true raphe

Habitat In the case of fresh water forms it will not be necessary to define the exact locations in which they may occur, as, during the entire year, more especially in the spring and fall months, they are found growing in pure or nearly pure water in roadside ditches, rivulets and streams, on dripping rocks of waterfalls, on the borders of lakes and in occasional rain pools, water troughs and aquaria The stems of water plants or other submerged objects and especially the brown mud coating the beds of streams will be found prolific in pure or nearly pure gatherings which may easily be detached and kept in bottles in formaline solution for determining the cell contents or until required for treatment with acids Marine diatoms are obtained from dredgings, the scrapings of vessels or pilings, the stomachs of fish, the cleanings of shells and particularly from the surface of salt marshes and tidal pools Marine algae, more often the red algae, are usually found to be covered with masses of diatoms Ice floes are the habitat of species not found elsewhere and plankton from northern bays and the shores of Greenland contains numerous representatives of the Arctic flora of Europe and Asia

Microscopic Appearance

Coleoderm. Surrounding each frustule and often the only cause of their adherence to each other, sometimes extended into a stipe for attachment to extraneous objects, is a thin coating of mucus known as the coleoderm. It is invisible, except when stained, and varies in thickness, being more abundant in young frustules. It contains a small quantity of silex from which, it is supposed, are formed the valves that, as observed by Peragallo in the calyptra of *Rhizosolenia*, grow centrifugally from the centre.

Frustule The frustule enclosed by the coleoderm consists of two separate, siliceous parts or valves, usually connected by a band or girdle known as the connective zone. The shape of the frustule may be cylindrical, sometimes flattened, or orbicular, box-shaped, linear, lanceolate, elliptical, cuneate, irregular, sigmoid, and symmetrical or asymmetrical, the outline often varying by reason of the appendages of the valves The appearance of the frustule when the zone is seen is called the *zone view* and when the end of the frustule is seen the *valve view* The frustules are sometimes divided into several parts by transverse partial or perforate septa.

Connective Zone The two parts of the frustule, known as valves, are, except in very young or immature forms, almost invariably connected by two or more bands united to the valves, the zone of one valve usually, except in *Fragilaria*, overlapping the edge of the zone of the other valve forming what is known as the *suture* The zone is more or less firmly united to the valve sometimes easily detached, but the two zones at the suture are capable of movement over each other and increase in width to accommodate the growth of the cell contents The zone may be composed simply of the two bands surrounding or enclosed by the edges of the valves and continuous, or it may be open at one part, not, however, opposite the opening of the opposing zone In the greater number of species it is simple and the markings are usually puncta in longitudinal rows In other forms the zone consists of more or less numerous annuli parallel to each other or of imbricated scales

Valve. The valves of which there are always two, omitting the so-called internal valves in certain species, are of almost infinite variety in shape, the most common forms being circular, either plane or convex, angular, linear or elliptical The size varies from 4 to 1300 μ in length All forms, without regard to outline, may be divided into two classes, those having concentric markings, known as the Centricae, and those in which the markings are separated by a median line or space or by a raphe into two parts, symmetrical or asymmetrical, and known as the Pennatae

Septa. The frustules are sometimes divided by partitions at right angles to the longitudinal axis In other cases the valves themselves are divided by septa which extend more or less deeply and are usually transverse In some species partial septa parallel to the surface form diaphragms at the ends

Appendages of the valves While the various projections are often described with the frustule they are parts of the valve, not being found on the connective zone Their function is almost invariably to act as connecting links in the formation of filaments and in species which no longer form continuous threads they either disappear or are represented by minute spines or apiculi They are extremely variable in shape and size and may occur as processes, conical or globular, as horns, cylindrical or conical, sometimes quite long, as setae, very long thread-like horns, as spines or shorter horns, and apiculi, or often merely the vacant spaces where they originally existed The calyptra, as found in *Rhizosolenia*, is probably to be considered of another character as it proceeds not from a corner of the valve nor exactly from the margin, as is the case of other appendages, although it serves as a means of connection between frustules. The long setae are found only in plankton forms and are of service in flotation, while the length of processes and horns is usually an indication of differences in the pelagic or littoral habitat

Markings In a general sense the markings of the valves may be considered as similar to the arrangement in a single stratum of cells of a leaf, consisting of an outer and an inner surface separated by cell walls. In most species the distinction between the outer and inner surface disappears while in others there is a marked difference In areolate or cellular markings distinguished from others by their greater size and visibility the distinction is more obvious, an interior or exterior stratum being perforate with minute puncta, the outer stratum being often an open network frequently covered only by the coleoderm. When the cells are large they are usually seen as hexagonal or angular and this is probably their shape in many cases when the markings, owing to their minuteness, appear as rounded dots *Ocelli*, in many instances, are smaller and the *granules* are still smaller than the cellular structure where the cell walls become thicker. *Puncta*, a somewhat indefinite term, usually designates the most minute markings which occur When the markings are very close together in rows they are said to be *lineate* and when confluent form costae. All alveolar or punctate markings are generally considered to be either actual perforations or cavities which may be covered by a thin siliceous membrane, often destroyed in preparation or in fossil deposits, or by the coleoderm, so that, except by osmosis, there is no actual communication in the living forms with the surrounding medium.

Raphe In the Pennatae there are two kinds of median line. In one, as in *Fragilaria*, the line consists of a blank space or pseudo raphe, while in the naviculoid forms, and, in a modified degree, in the Surirelloideae, the line is a true cleft which divides the valve into parts connected usually in the middle, by the central nodule or only at the ends The central nodule may be either a conical projection inward, as in *Pinnularia*, or a simple thickening of the centre, sometimes transversely extended into a stauros, as in *Stauroneis*, or produced longitudinally on each side of the raphe in the form of thick siliceous horns, as in *Diploneis* At the beginning of the raphe, above and below the central nodule, are median pores and at the ends of the raphe are terminal pores which are merely the ends of the raphe curved or incrassate

Cell Contents

Enclosed within the siliceous valves the cell contents include the cytoplasma, protoplasm, cell sap, endochrome, nucleus, nucleolus, centrosome, double rods or plates, volutin, oil drops, pyrenoids and certain granules Some of these, however, may be absent in certain species

Cytoplasma The inner surface of the cell is covered with a layer of plasma, colorless, except in *Navicula ostrearia*, where it is blue, and not evident except in plasmolysis It varies in thickness in different genera and is usually collected at the ends in long forms and condensed at the plasma bridge in the centre, dividing the cell into two parts, each containing the protoplasm, cell sap and certain granular bodies; in cylindrical frustules it sometimes occupies a great part of the cell.

Endochrome. The endochrome occurs either as a single plate or a number of plates or separate granules known as chromatophores which are variable in size but usually constant in position, except during the process of reduplication, and are more permanent than other contents of the frustule, being frequently capable of recognition long after the cells are dead It apparently consists of chlorophyl united with a yellow coloring matter and varies from a light greenish yellow to a dark brown, but, after the death of the cell, becomes greenish The function of the endochrome is probably the same as that of ordinary chlorophyl. A few species, not yet recorded in North America, including *Nitzschia putrida* Benecke (Jahr f. wiss. Bot Berlin. 35 535 1900) and *Synedra hyalina* Provazek (Oestrerr. Bot Zeitschr Wien 69. 1900) are saprophytic and without chromatophores.

Pyrenoids In the chromatophores, or, sometimes, on their inner surface, of many species are found colorless, homogeneous, strongly refractive bodies, of various shapes, known as pyrenoids, considered as excess working material resembling crystalloids in other plants, and appear to be concerned in the formation and division of the endochrome They become evident when stained with haematoxylin

Double Plates. Small bodies appearing as double plates or double rods, according to position, sometimes, especially in certain naviculoid forms, as *Pinnularia*, occur as short, parallel plates in pairs in the plasma mass and radiate from the centrosome They are evident in the plasma bridge, but, in the beginning of cell division, become more and more indistinct and disappear, and again are visible after division Their substance is supposed to be a reserve material of importance in cell division

Volutin In various parts of the cell, more often in the cytoplasma or cell sap, are found, in many species, strongly refractive bodies, known as volutin or Bütschli granules, or red granules when stained, which are considered to be a nitrogen reserve store They vary in appearance and size In *Navicula cuspidata* they consist of two large globules, one above and one below the plasma bridge, in *Surirella* they are often arranged in a row along the upper and lower edges of the plasma bridge; in *Pinnularia major* they are seen in various positions scattered through the cell. They can be readily mistaken for oil drops which, however, are not usually so constant in position while the volutin granules are so definitely arranged in different species as to be of value in classification

Nucleus. The nucleus is a spherical, spheroidal, lenticular, bean-shaped or kidney-shaped body varying from 2–47 μ in diameter not, however, proportional to the size of the frustule, and is found usually near the centre of the cell, sometimes nearer one zone In most species the nucleus contains darker bodies, the nucleoli, varying in number from one to ten When the cell is at rest the nucleus is filled with a network of lines at the crossings of which are found minute chromatin granules, and these, with the broken lines of network form, in the process of cell division, the chromosomes

Centrosome The "germinal dot," discovered by H. L. Smith (Proc. Amer Soc Microscopists, 57. 1886), later (1891), described by Bütschli as the centrosome, is a small, round body near or at the centre toward which converge the double plates and the plasma threads. It is always in intimate connection with the nucleus by plasma threads and is considered by Lauterborn as "a kinetic centre from which proceed the changes, including the streaming of the protoplasm, in the beginning of the action of cell division upon the nucleus and the plasma "

Oil Drops. The assimilation products, starch and sugar, are not found in the diatom cell but are replaced by oil in the form of globules of various size and shape occurring in the cytoplasma or the cell sap and occasionally in the chromatophores They sometimes occupy, in certain species, a constant position, being found in *Navicula cuspidata* on the border of the plasma bridge, while in *Pinnularia* they are scattered through the cell and are not easily distinguished from the volutin granules, although, in the process of staining they are sometimes dissolved They are more apparent immediately after the death of the cell and are probably, in part, the cause of the peculiar odor late in summer, noticed in certain years, in the water supply

(*Note* In order to understand the nature and position of the cell contents immerse freshly gathered specimens of *Pinnularia major* in a ten per cent aqueous solution of picric acid for a few days After washing out the acid and neutralizing with carbonate of soda stain in haematoxylin, pass through successively increasing percentages of alcohol in water, place in oil of cloves and mount in benzole balsam Examine the frustules in zone view In the centre is the double concave mass of the plasma bridge, somewhat contracted in preparation, and within it is the nucleus, about one-third the diameter of the frustule Inside the granulated nucleus will be found two small, dark, round bodies, the nucleoli Appearing near the centre of the nucleus although not within it is the small centrosome All of these are seen through the chromatophore which lines the zone. Radiating from the centrosome are the double plates The condition thus shown will be the appearance of the cell at rest.)

Cell Division

The simplest form of reproduction in diatoms and one which has been observed in most genera is that of reduplication in which the frustule, after an increase or extension of the connective zone, forms two new valves, with their connectives, within the mother valves, each of which united to its daughter valve produces a new frustule which continues to repeat the process during its vegetative existence It follows that as new frustules are formed within the older, a constant diminution must take place, at least in those forms the connective zones of which are incapable of expansion When, therefore, the cell has been reduced to a certain size an auxospore is formed in which the zone expands and produces an enlarged cell which either is detached from the filament or continues dividing In ordinary reduplication the cell contents follow the usual method of cell division in other plants As certain modifications occur in diatoms the following condensed statement of Lauterborn's investigations in the nuclear division of *Surirella* is given (Untersuchungen über Bau, Kernteilung und Bewegung der Diatomeen, 1896)

The first indication of cell division is the gradual separation of the zones and the withdrawal of the chromatophores within the borders of the valves The centrosome now withdraws from near the nucleus and the streaming of the protoplasm toward the centrosome becomes apparent Close to the centrosome and apparently budding from it is seen a small round body which finally detaches itself and approaches the nucleus, gradually increasing in size At this time the network of the nucleus becomes coarser and irregular, the chromatin granules, which in the resting condition are gathered chiefly at the node points, begin to arrange themselves like strings of pearls The central plasma now begins to move toward the broad end of the cell. The small body near the centrosome grows larger, assuming several forms, and later becomes rod-like and forms the central spindle which then enters the nucleus through its dissolved outer membrane, and places itself at right angles to the longitudinal axis of the frustule Changes occur in the nucleus where the network arranges itself in the form of dark threads radiating from the central spindle, forming what is known as the mother star The spindle appears now as a sheaf-like form with convex ends and gradually the radiating threads divide into two parts, each part moving to the end of the spindle, beginning the second phase of division The central spindle now divides and the two parts of the mother star, each of which is known as the daughter star, form rounded bodies composed of the dark threads which, from the time of their formation from the network of the nucleus, are known as the chromosomes. The ends of the central spindle become rounded while the spindle grows less evident, although the two parts are still connected by threads.

In the meantime the cell division has begun The central spindle gradually disappears and the pole ends assume the form of round bodies which become the centrosomes of the new frustules Here ends the second phase The third phase is one of reconstruction in which the processes described are reversed Each of the daughter chromosome rings resolves itself into a nucleus and the chromosomes are reduced to the original network The valves are entirely separated and the daughter valves appear The two nuclei move down with the divided plasma bridges and take up their position near the middle of the cell, the chromatophore bands divide and soon two new frustules are formed similar in every respect to the original The entire operation to the end of the second phase occupies about thirteen hours

Reproduction

Sexual reproduction in diatoms has been observed in many species Among the several methods described, about which there has been much controversy, one alone appears 'to be recognized as determined In this, the result of numerous observations, two frustules approach each other, the valves separate, the contents of the frustules unite and a sporangium is produced which forms two new valves, usually larger than those of the parent frustules and often differing in outline and striation The sporangial frustules are supposed to continue the vegetative method of reduplication and finally to assume the normal form This method of reproduction accounts for numerous irregular forms in *Gomphonema*, *Nitzschia*, *Synedra*, *Fragilaria*, and other genera

In the case of *Neidium*, H L Smith states that two frustules unite and produce two sporangia

In certain genera internal spores have been discovered but they are apparently not due to conjugation

In addition, however, to the usual method of vegetative reduplication and the formation of sporangia by sexual reproduction, several genera, notably *Chaetoceros* and *Rhizosolenia*, form internal spores or endocytes which are resting spores provided for the period of seasonal quiescence The Centricae, for the most part, have, apparently, no method of reproduction, irrespective of ordinary cell division, except that of internal spores, while the Pennatae have in addition conjugation and the formation of sporangia. In *Biddulphia*, at least in one species, *B laevis*, the auxospores are formed in a manner similar to that of *Melosira varians.* (T C. Palmer, in Boyer, Diat. of Philadelphia, 33, *pl 7, f 10*) In *Chaetoceros*, besides the formation of resting spores, a peculiar method of auxospore development has been discovered in which the cell contents pass through the wall of the zone and produce an enlarged cell which continues by reduplication anothe chain of frustules at right angles to the original chain (Schütt, Ber Deutsch Bot Ges 7 362. *pl 14, f. 4-8.* 1889)

Movement of Diatoms

With the exception of the well-known *Nitzschia*, usually called *Bacillaria paradoxa*, the independent movement of frustules is confined to free forms In the Surirelloideae where the raphe is less defined, the motion, if there is any, is not so obvious as in the Naviculoideae where the raphe is more pronounced and the action more rapid It appears to be determined that the advance and withdrawal is a creeping, interrupted at regular intervals, over some object and not a free swimming in the water Mr T Chalkley Palmer's investigations (Proc. Delaware County Institute of Science, 1 116 1896 and 3 70. 1908) prove conclusively that the movement is due entirely to the protoplasmic action of the part of the coleoderm in the position of the raphe

Distribution

Of the two divisions of the Diatomae it may be said that the Centricae are almost exclusively marine or brackish forms, the exceptions including only certain species of the genera *Melosira* and *Cyclotella*, although *Coscinodiscus subtilis*, *Biddulphia laevis* and *Terpsinoë musica*, sometimes exist in waters apparently fresh but subject to saline influence.

Pelagic forms The plankton and pelagic diatoms are included in the genera *Thalassiosira*, *Skeletonema*, *Asteromphalus*, *Asterolampra*, *Rhizosolenia*, *Dactyliosolen*, *Chaetoceros*, *Bacteriastrum*, *Ditylum*, *Corethron*, *Hemiaulus*, *Trinacria*, nearly all species of which are found chiefly in northern latitudes.

Littoral forms. The strictly littoral diatoms differ from the plankton and pelagic in being attached, in most cases by stipes, or are sessile on algae, rocks, etc. although they are more often found, when not in situ, floating free. Those occurring in short chains attached to extraneous objects by a stipe from the lowest cell include *Melosira*, *Podosira*, *Hyalodiscus*, *Stephanopyxis*, *Eucampia*, *Isthmia*, *Terpsinoë* and certain Biddulphiae Those which are found sessile include *Cyclotella*, *Coscinodiscus* (in part), *Stephanodiscus*, *Actinoptychus*, *Polymyxus*, *Arachnoidiscus*, *Stictodiscus*, *Aulacodiscus*, *Actinocyclus*, *Euodia*, *Roperia*, *Eupodiscus*, *Auliscus* and *Pseudauliscus*. *Attheya* occurs free on the shore In the collection of these forms, however, they are usually found floating free, with frustules detached.

The second division of the Diatomae, the Pennatae, is not only characterized by a more varied form and structure but also by a more varied habitat The Pennatae are found not only as pelagic and littoral forms but as including nearly all fresh water genera Of the first group, the Fragilariatae, more closely connected, if at all, with the Centricae, in general structure, than the other groups, are also more generally exclusively marine and all, with the exception of *Meridion*, *Tabellaria*, *Tetracyclus*, *Ceratoneis* and *Actinella*, contain marine species Of the second group, the Naviculatae, two, *Anorthoneis* and *Campyloneis*, are exclusively marine, *Gomphoneis* is exclusively fresh water, while all of the others inhabit marine, brackish or fresh water Of the third group, the Surirellatae, two small genera, *Podocystis* and *Plagiodiscus*, which are not typical of the group, are the only ones exclusively marine, the others being found everywhere

To localize the marine genera it must be realized that many forms are carried northward from the region of the West Indies by the Gulf Stream, while the Arctic current is responsible for certain species found off the northern coasts of the United States The plankton forms occur more abundantly in northern latitudes and are seldom seen near the coast A peculiar flora of the ice floes is represented in certain species of *Navicula* and *Pinnularia*. To the southward, the genus *Mastogloia* is confined almost entirely to the Bahamas where it is abundant on algae. *Plagiogramma* is also characteristic of the same region as well as of Campeche Bay and Colon. *Biddulphia* is more abundant southward while *Coscinodiscus* may be said to be generally distributed on both the Atlantic and Pacific coasts The Naviculae are, as in other parts of the world, found in all waters On the Pacific coast the prevailing genera are *Aulacodiscus*, *Arachnoidiscus* and *Isthmia*, the last of which is rarely found on the Atlantic coast, while *Arachnoidiscus* occurs in the east only in a rare variety of a fossil species in Maryland

In attempting to distinguish the fresh water floras of the North American continent it is necessary only to consider the Appalachian slope, the Mississippi valley and the Rocky Mt and Cascade ranges The flora of the Great Lakes may be recognized by the greater abundance of *Gomphonema*, *Stephanodiscus* and one or two species of *Rhizosolenia*, a genus usually considered as marine *Pinnularia*, *Neidium*, *Anomoeoneis* and *Caloneis* are abundant in the provinces of Quebec, Nova Scotia, New Brunswick, and the states of Maine, New Hampshire, and Vermont, occurring in vast peat deposits and, for the most part, extant in the numerous lakes formed after the glacial period The Mississippi valley, with its numerous tributaries, is characterized more by the absence of any but the common forms of *Navicula*, *Synedra*, etc the reason for which is, possibly, the turbid condition of the streams The Rocky Mt region is also rather barren of forms and the Cascade range, while not sufficiently explored, does not appear to be prolific although it may be expected that the lakes of Oregon will be found worthy of further examination

The determination of habitat is occasionally dependent upon factors not always recognized Many forms adhere to the legs of insects and water birds and are sometimes carried to great distances, while others find location on the scales of fishes as well as in their stomachs Vessels also, on their anchors and on the barnacles along their sides are vehicles of transportation Algae, covered with sessile species, torn from rocks by storm, float away and are cast on distant shores Fossil forms, also, are not absent from the rivers of Maryland, Virginia, and Oregon

This synopsis is intended to comprise all recent species occurring in North America, including the West Indies, and descriptions are chiefly from specimens of my own collection in various parts of Canada, New England, and the Middle and Western States In certain cases the actual specimens have not been available and in these the descriptions are attributed to the authorities whose names occur in parentheses. The same rule has been observed in the statement of distribution when not verified

An examination, also, has been made of slides prepared by Möller, Thum, Klavsen, Tempère, Dr. F. D. Lewis, Christian Febiger, Dr D B. Ward, W. A. Terry, H L. Smith, C. L. Peticolas, Miss M. A. Booth, and others. Slides and material have been received from numerous friends and correspondents and I here wish gratefully to acknowledge the kindness of the following· Robert Hagelstein, Mineola, N Y, the late Dr L W Bailey, Fredericton, N B, Miss S P Monks, San Pedro, Cal, Prof. C J Elmore, College of Emporia, Kansas, Dr D E Owen, Philadelphia, Dr Vida A Latham, Chicago, H C Wheeler, Montreal, C Mereschkowsky, formerly of St Petersburg, Prof L H Tiffany, Ohio State University, Dr Leonard Waldo, Plainfield, N. J, Fullerton, L Waldo, Philadelphia, Dr Marshall A Howe, New York, T Chalkley Palmer, President of the Academy of Natural Sciences, and the following members of the Academy F J Keeley, especially for assistance in measurements, John A Shulze, Hugo Bilgram, E G Vanatta; Dr H A Pilsbry, Mrs Eva B Gadsby, Dr Thomas S Stewart My thanks are due to Dr John Hendley Barnhart, the noted bibliographer, for valuable suggestions in regard to citations

Note As it is not intended to include species exclusively fossil nor to describe specimens found only as dead valves, it has been difficult, in some cases, to distinguish the habitat of forms occurring in dredgings at a distance from the coast Species found on ice floes in the Polar Sea, forming a flora quite distinct, are included when near the coast and certain others carried by streams from fossil deposits are omitted although mention is made of some which may be considered doubtful

ANALYSIS OF GENERA

A CENTRICAE	I COSCINODISCATAE	1 Coscinodisceae
		2 Actinoptycheae
		3. Eupodisceae
	II RHIZOSOLENATAE	4 Rhizosolenieae
	III BIDDULPHIATAE	5 Chaetocereae
		6 Biddulphieae
		7. Anauleae
B. PENNATAE	IV FRAGILARIATAE	8 Tabellarieae
		9 Meridioneae
		10 Fragilarieae
	V NAVICULATAE	11 Achnanthideae
		12 Cocconideae
		13 Cymbelleae
		14 Frustuleae
		15 Caloneideae
		16. Naviculeae
		17 Amphiproreae
		18 Epithemieae
	VI SURIRELLATAE	19. Nitzschieae
		20 Surirelleae

CENTRICAE

Coscinodiscatae Frustules discoid, cylindrical or spherical Valves without horns or elevations, sometimes with short spines or processes.	
Coscinodisceae Valves not divided by rays or costae into sectors Processes absent	
(a) Meloseirinae Frustules short, usually in filaments	
Valves hemispherical or cylindrical. Frustules in long filaments	1 *Melosira*
Valves hemispherical Frustules solitary or in twos or threes, stipitate	2 *Podosira*
Valves convex, with an umbilicus and a broad border of decussating lines	3. *Hyalodiscus*
Valves convex, with a border of a crown of spines	4 *Stephanopyxis*
(b) Coscinodiscinae Frustules disc-form or cylindrical, single or in chains.	
Frustules solitary or geminate, with a wide border and undulating surface	5. *Cyclotella*
Frustules solitary. Valves discoid, areolate or punctate, with a narrow border. Margin without large spines, sometimes with apiculi	6. *Coscinodiscus*
Frustules usually solitary Valves circular Margin usually with a crown of spines	7 *Stephanodiscus*
Frustules in long chains connected by mucous threads from the centre of the valves	8 *Thalassiosira*
Frustules in chains connected by numerous threads from the border of the valves	9 *Skeletonema*
Actinoptycheae Valves divided into sectors Processes absent; small spines sometimes present	
Valves divided into plane sectors, areolate and punctate	10. *Actinoptychus*
Valves divided into convex, punctate sectors.	11. *Polymyxus*
Valves divided into sectors by radiate costae.	12. *Arachnoidiscus*
Valves divided into sectors by radiate, hyaline lines.	13. *Stictodiscus*
Valves divided by hyaline rays into marginal, equal, punctate segments.	14. *Asterolampra*

Valves divided by hyaline rays into unequal, cellular segments. 15 *Asteromphalus*

Eupodisceae Valves disc-shaped, with mammiform processes or ocelli.

(a). Aulacodiscinae. Valves with mammiform processes.

Valves circular, with two or more inflated processes on the border. 16 *Aulacodiscus*

(b) Eupodiscinae Valves with ocelli.

Markings granular or punctiform, in radial, sometimes fasciculate rows. A small nodule near the border 17 *Actinocyclus*

Markings granular, in radial or irregular rows A small nodule usually near the border. Valves semicircular. 18 *Euodia*

Markings cellular, irregular An ocellus near the border 19. *Roperia*

Markings cellular, irregular. Several large ocelli near the border 20. *Eupodiscus*

Markings costate and granular. Ocelli large 21. *Auliscus*

Markings granular, radiate Ocelli large 22 *Pseudauliscus*

Markings minute, radiate Ocelli small 23. *Rattrayella*

RHIZOSOLENATAE Frustules frequently much elongated, with numerous girdle bands

Rhizosolenieae Characters of the group.

Frustules often in filaments, cylindrical or nearly so

Annuli narrow or in imbricated scales Valves terminated by a calyptra. 24 *Rhizosolenia*

Frustules in filaments, cylindrical, with narrow annuli half the circumference, imbricated. 25 *Dactyliosolen*

Frustules annulate, united by short spines 26 *Lauderia*

BIDDULPHIATAE Frustules box-like, valves with two or more angles or horns

Chaetocereae Valves circular or elliptical, with horns or setae much longer than the frustules.

Frustules in long filaments, separated by foramina and united by setae in pairs. 27. *Chaetoceros*

Frustules in filaments without foramina. Setae at right angles to the filament, numerous 28. *Bacteriastrum*

Frustules free or geminate. Valves hemispherical. Setae in a crown on the margin oblique to the filament. 29 *Corethron*

Frustules free, annulate. Valves with a central punctum and a seta at each end 30 *Attheya*

Biddulphieae. Valves orbicular, elliptical, triangular or polygonal. Horns short or represented by spines or elevations of the angles, sometimes absent.

Frustules in spiral chains, usually with foramina Valves elliptical 31 *Eucampia*

Frustules prismatic. Valves with undulating sides and a stout bristle in the middle 32. *Ditylum*

Frustules box-like. Valves elliptical or angular, with ends or angles elevated or prolonged into horns or spines. 33 *Biddulphia*

Frustules asymmetrical. Valves with the structure of Biddulphia but elevated at one end only 34 *Isthmia*

Frustules compressed Valves with angles produced into horns tipped with a spine Outline elliptical 35. *Hemiaulus*

Frustules with valves as in *Hemiaulus* but triangular in outline. 36 *Trinacria*

Anauleae Valves elliptical or lunate, with transverse septa Horns short or absent

Valves elliptical, divided into three parts by septa 37. *Anaulus*

Valves lunate, divided by two or more septa 38. *Eunotogramma*

Valves elliptical, with a truncate process at each end 39 *Huttonia*

Valves elliptical or triangular, the septa usually curved in zone view, prominent 40. *Terpsinoë*

Valves rounded at the ends, inflated in the middle, with two septa 41 *Porpeia*

PENNATAE

Fragilariatae Valves without a raphe, usually with a pseudoraphe or median line

Tabellarieae. Valves symmetrical with respect to both the longitudinal and transverse axes; septate, not cuneate.

(a) Tabellariinae. Frustules septate. Valves alike.

Frustules with numerous septate partitions and one or several foramina Transverse costae or rows of coarse puncta. 42. *Rhabdonema*.

Frustules with from two to six nearly straight septa Transverse striae subtly punctate	43	*Tabellaria*
Frustules with two straight, perforate septa.	44.	*Diatomella*
Frustules with numerous curved, perforate septa	45.	*Tetracyclus*
Frustules with two sinuate, perforate, curved septa	46.	*Grammatophora*
Frustules with alternate partitions, septate or partly so.	47	*Striatella*
(b) Entopylinae Frustules septate, arcuate Valves arcuate, unlike.		
Costae on each side of the pseudoraphe alternating.	48.	*Entopyla*
Costae on each side opposite each other.	49	*Gephyria*
Meridioneae. Valves symmetrical to the longitudinal, asymmetrical to the transverse axis, cuneate or clavate.		
Frustules cuneate, in stipitate, fan-shaped fascicles Valves with a narrow or indistinct pseudoraphe Septa rudimentary	50.	*Licmophora*
Frustules cuneate, elongate, stipitate. Septa complete, perforate	51	*Climacosphenia*
Frustules cuneate, without septa Valves cuneate, costate	52	*Meridion*
Frustules cuneate Valves clavate, not costate or septate	53	*Sceptroneis*
Fragilarieae Valves not cuneate, costate or with transverse rows of puncta		
(a) Diatominae Valves varying from nearly circular to linear and cruciform, with transverse costae. Pseudoraphe sometimes wanting		
Frustules in filaments. Valves linear or elliptical.	54	*Diatoma*
Frustules in short fasciae or free.	55.	*Plagiogramma*
Frustules free Valves usually cuneiform.	56.	*Opephora*
(b). Fragilarinae Chiefly characterized by transverse striae and a more or less distinct pseudoraphe. Valves not costate.		
Frustules usually in filaments. Valves linear to elliptical, without nodules. Striae transverse.	57.	*Fragilaria*

Frustules free Valves linear to elliptical, with radiating striae.	58. *Rhaphoneis*
Frustules free. Valves cuneiform	59 *Trachysphenia*
Frustules in short fasciae. Valves lanceolate, punctate Pseudoraphe absent.	60 *Cymatosira*
Frustules in short fasciae or free Valves with smooth apices. Pseudoraphe broad.	61 *Dimerogramma*
Frustules in fasciae or free Valves with a central nodule.	62. *Glyphodesmis*
Frustules stipitate, in clusters or free Valves elongate, with transverse striae and distinct pseudoraphe	63 *Synedra*
Frustules free Valves oar-shaped	64 *Pseudosynedra*
Frustules free. Valves arcuate, clavate, inflated.	65 *Campylostylus*
Frustules in radiating clusters Valves and frustules inflated at the ends	66 *Asterionella*
Frustules in radiating clusters. Valves linear, arcuate.	67. *Thalassiothrix*
Frustules free Valves elongate, inflated at the ends	68 *Clavicula*
(c). Eunotiinae Valves lunate. A partial raphe sometimes formed; nodules near the edges.	
Frustules free, in fasciae or epiphytic Valves arcuate, usually with terminal nodules.	69 *Eunotia*
Frustules solitary. Valves dentate on both margins	70 *Amphicampa*
Frustules free. Valves with a partial excentric pseudonodule in the middle of the concave side	71 *Ceratoneis*
Frustules free or geminate Valves arcuate, inflated at one end	72 *Actinella*
NAVICULATAE Valves, or at least one of them, with a true raphe and central nodule	
Achnanthideae Frustules arcuate. Valves dissimilar	
Valves linear to elliptical, one with a raphe, the other with a median line	73. *Achnanthes*
Valves with diaphragms at the upper ends. One valve with a raphe, the other with a median line. Frustules cuneate	74. *Rhoicosphenia*
Cocconeideae Frustules not arcuate Valves dissimilar.	

Valves with raphe and median line excentric.	75	*Anorthoneis*
Valves with a network between them.	76	*Campyloneis*
Valves with raphe and median line central, without network, sometimes with a loculiferous rim Frustules sometimes bent along the longitudinal or transverse axis	77	*Cocconeis*
Cymbelleae Valves asymmetrical along the longitudinal or transverse axis		
Valves with the plane through the dorsal and ventral margins of one valve at an angle with the plane of the other valve	78	*Amphora*
Valves parallel, cymbiform or arcuate	79	*Cymbella*
Valves asymmetrical to the transverse axis, punctate	80	*Gomphonema*
Valves asymmetrical to the transverse axis, punctate and costate	81	*Gomphoneis*
Frustulieae Valves with the central or terminal nodules or both elongated		
Valves with central and terminal nodules elongated	82.	*Frustulia*
Valves with central nodule extending half the length of valve and forking at the ends	83	*Amphipleura*
Valves with median nodule elongated and terminal nodules distant from the ends	84	*Brebissonia*
Valves linear, with rounded ends, the median line bordered by two siliceous ribs	85	*Stenoneis*
Valves rectangular, the median line between two siliceous ribs	86	*Cistula*
Caloneideae Valves with longitudinal lines or blank spaces		
Valves with transverse striae interrupted by longitudinal lines near the border	87	*Caloneis*
Valves with finely punctate striae interrupted by longitudinal blank lines Median pores in opposite directions	88	*Neidium*
Valves with punctate striae interrupted by longitudinal areas	89	*Anomoeoneis*
Naviculeae Valves similar and symmetrical, without elongated nodules, usually without longitudinal blank lines		
Valves with septate, loculiferous plates near the margin	90.	*Mastogloia*
Valves with an outer punctate and an inner cellular stratum. Marginal cells appearing like loculi	91.	*Dictyoneis*

Valves with central nodule prolonged into two horns parallel to the median line.	92.	*Diploneis*
Valves with sigmoid median line enclosed between longitudinal lines	93	*Scoliopleura*
Valves divided longitudinally by ridges on each side of the median line.	94	*Cymatoneis*
Valves linear to elliptical, with axial and central areas usually distinct Striae punctate, lineate or nearly smooth.	95.	*Navicula*
Valves linear to elliptical, axial area distinct, central area a stauros	96	*Stauroneis*
Valves with a finely punctate outer stratum, an inner coarsely punctate, and intermediate costae	97	*Trachyneis*
Valves usually linear, with broad axial area and smooth costae	98.	*Pinnularia*
Valves usually sigmoid or with sigmoid raphe and longitudinal and transverse, punctate lines	99	*Gyrosigma*
Valves and raphe usually sigmoid Striae transverse and oblique	100.	*Pleurosigma*
Valves asymmetrical Raphe arcuate Striae oblique	101.	*Toxonidea*
Valves with median line sigmoid enclosed between longitudinal lines Striae costate, with intermediate puncta	102	*Scoliotropis*
Valves with a central area dilated into a partial stauros uniting with a blank line on each side	103	*Pseudoamphiprora*
Amphiproreae Valves with a keel enclosing the raphe		
Valves with a straight median line on a central or excentric keel.	104	*Tropidoneis*
Valves with axial area elevated into a sigmoid keel enclosing the raphe.	105	*Amphiprora*
Valves arcuate or reniform, with an elevated keel.	106.	*Auricula*
Epithemieae Valves not strictly naviculoid but with a partial or concealed raphe. Allied to *Eunotia*, *Amphora* and *Nitzschia*,		
Valves arcuate, with an internal septum.	107.	*Epithemia*
Valves usually lunate or linear, with the raphe on the margin	108.	*Rhopalodia*
Valves asymmetrical, semilunate	109.	*Catenula*

SURIRELLATAE Valves with the raphe in a more or less concealed keel on one or both sides of the valve		
Nitzschieae Valves with the keel more or less excentric, without wings		
Frustules free Valves with the keels usually diagonally opposite each other	110	*Nitzschia*
Frustules free Valves arcuate, with keels opposite each other	111	*Hantzschia*
Frustules enclosed in tubes	112	*Homoeocladia*
Frustules with the apices of the costae in zone view capitate	113	*Denticula*
Surirelleae Valves with the keel on each side, often forming undulations, or with a structure resembling that of *Surirella*		
Frustules free Valves with transverse undulations	114	*Cymatopleura*
Frustules free Valves with more or less undulated keel forming wings on each side.	115	*Surirella*
Frustules attached by stipes Valves ovate	116	*Podocystis*
Frustules free Valves reniform	117	*Plagiodiscus*
Frustules free, saddle-shaped Valves with costae or rays converging toward the central area	118	*Campylodiscus*

Diatomaceae are divided into two distinct classes according to the arrangement of the markings of the valves

A. Centricae Valves without a dividing line or cleft Markings more or less radiate

B. Pennatae Valves zygomorphous Structure pinnate, not concentric Valves divided by a true raphe or cleft or by a line or linear space

A. CENTRICAE

Transverse section of frustule circular, polygonal or triangular, sometimes irregular. Chromatophores usually coccochromatic and numerous. The Centricae differ from the Pennatae not only in cell contents and striation of the valves but also, to a certain extent, in habitat and reproduction. They are all immotile

The Centricae are divided into three groups.

I. Coscinodiscatae Frustules discoid Valves without horns or elevations, sometimes with processes Chromatophores coccochromatic Reproduction by auxospores or by internal spores.

II Rhizosolenatae. Frustules with numerous girdle bands, frequently much elongated Chiefly pelagic and plankton forms Chromatophores various. Reproduction usually by internal spores

III Biddulphiatae. Frustules box-like, i e, with the longitudinal axis greater than in the Coscinodiscatae Valves with two or more angles, elevations or horns Chromatophores coccochromatic. Reproduction, in certain genera noted, by spores or auxospores

I COSCINODISCATAE

The Coscinodiscatae are divided into three sub-groups

Coscinodisceae. Valves not divided by rays or costae into sectors, markings sometimes radiate, ocelli or processes absent

Actinoptycheae Valves with striae divided into sectors; ocelli and processes absent, sometimes with small spines

Eupodisceae. Valves disc-shaped, with mammiform processes or one or more ocelli

1. Coscinodisceae

The Coscinodisceae are divided into two sections

(a) Meloseirinae Frustules short, in chains

(b) Coscinodiscinae. Frustules disc-form, cylindrical, single or in chains

(a) MELOSEIRINAE

Meloseira Valves punctate, or areolate hemispherical or cylindrical, sometimes with a constriction or furrow between the suture and the edge of the valve Frustules usually in long chains

Podosira Frustules spherical, solitary, or in twos or threes, stipitate Valves finely punctate

Hyalodiscus. Valves with an umbilicus and a broad border of decussating lines.

Stephanopyxis. Valves areolate, border with a crown of spines

1 MELOSEIRA Ag Syst Alg XIV 1824

Frustule globose, elliptical or cylindric Valves either simply punctate or punctate and areolate Chromatophores compressed circular or irregular granules along the wall of the cell Auxospores from lengthened cells the zones of which separate and between them is formed from the cell contents a spheric cell twice the diameter of the original. The auxospore soon becomes detached from the filament and begins the formation of another filament by reduplication. Resting spores occur in *M hyperborea*

Type species, *Fragilaria nummuloides* Lyngb.

The synonymy of species of *Meloseira* Ag., as variously interpreted by Kützing, Thwaites, W. Smith, Van Heurck, Peragello, and others, is more complicated than that of any other genus of Diatomaceae. The descriptions and figures of Dillwyn and

Lyngbye are insufficient and references to them and earlier writers are contradictory The synonyms given by Kützing for *M nummuloides* Ag and *M. moniliformis* Ag cannot, under any circumstances, be harmonized and, apparently, the only method remaining of determining identification is by reference to figures given by Kützing, W Smith, and Van Heurck. *Lysigonium* and *Gaillonella* would be convenient as distinctive genera if they were not inextricably involved in confusion with other species, and as the North American forms to be described are known and have been identified for many years under *Melosira* Ag this genus is here adopted as inclusive

Markings areolate and punctate	
Frustules disc-shaped, deeply furrowed on the margin	1 *M sulcata*
Markings punctate	
Frustules globose or ellipsoid Valves with a keel	
Keel on the convex edge of valve	2 *M nummuloides*
Keel near the junction of frustules	3 *M hyperborea*
Frustules globose. Valves not keeled	4 *M borreri*
Frustules cylindric Valves convex	
Valves finely punctate	5 *M. juergensii*
Valves subtly punctate	6 *M. varians*
Frustules cylindric, constricted near the valve surface, valves convex	
Frustules coarsely striated longitudinally	7. *M roeseana*
Frustules finely punctate, denticulate at margin.	8 *M. epidendron*
Frustules punctate, valves with internal polygonal figure	9. *M. undulata*
Frustules cylindric, disc-shaped, valves plane, with coarse, costate rays.	10 *M sol*
Frustules cylindric, more or less elongated, valves plane, with scattered puncta	
Frustules finely punctate	
Valves denticulate on the margin	11 *M. crenulata*
Valves slightly denticulate.	12. *M crotonensis*
Valves not denticulate	13 *M distans*
Frustules coarsely punctate	14 *M. granulata*

1. **Melosira sulcata** (Ehrenb.) Kütz., Bac. 55 1844
Gallionella sulcata Ehrenb Inf 170. 1838
Orthosira marina W Smith, Syn Brit. Diat 2 59 1856.
Paralia marina (W Smith) Heib, Consp Diat 33 1863

Frustules robust, disc-shaped, furrowed on the margin, areolate and punctate Valves concave, hyaline at the centre, with numerous coarse rays radiating toward the broad margin. Margin with a double row of cells, the outer row appearing as a crown of teeth. Diam of v 20–40 μ

Type locality Miocene deposits

Distribution Marine and brackish Atlantic and Pacific coasts.

Illustrations Ehrenb Mikrogeol pl 18, f. 1 a–c, W. Smith, Syn Brit Diat 2. pl 53, f 338, Van Heurck, Syn Diat Belg pl. 91, f 16, Boyer, Diat Phila. pl 1, f 11, 12.

Valves with hexagonal and polygonal outline occur southward. A Schmidt, Atlas, pl 176, f 17–19

2 **Melosira nummuloides** (Lyngb) Ag Syst Alg 8 1824.

Fragilaria nummuloides Lyngb, Tent Hydrophyt Dan 184 1819 •
Gaillonella moniliformis Bailey, Am Jour Sci 42· 89 1842

Frustules globose or ellipsoid, flattened at the ends Valves with lines of fine puncta, 20 in 10 μ, radiating from the hyaline central space A crest or collar on the convex edge of the valve Diam of v 30 μ

Type locality Europe

Distribution Marine or brackish. Atlantic coast

Illustrations Lyngbye, Tent Hydrophyt Dan pl 63, C; Bail, Am Jour Sci 42 pl. 2, f. 3, Kütz Bac pl 3, f 3, Van Heurck, Syn Diat Belg pl 85, f 1, 2, Boyer, Diat Phila pl 1, f 13, 14, H L Smith, T S 227

3 **Melosira hyperborea** Grun., in Van Heurck, Syn Diat Belg pl 85 1881

Frustules globose or ellipsoid, flattened at the ends Valves with radiating lines of fine puncta and a collar or crest less pronounced than in *M mummuloides* and closer to the junction line between the frustules. Diam. of v 25 μ. Auxospores are formed as in *Chaetoceros* (Gran, Diat Arctic, 53 1900), similar to resting spores.

Type locality· Arctic Sea.

Distribution Marine, Ice floes, Coast of Greenland.

Illustrations. Van Heurck, Syn Diat Belg. pl 85, f. 3, 4, Gran, Diat Arctic, 1900 pl. 3, f 11–15.

4. **Melosira borreri** Grev ; Hook in Smith Eng Fl 5 401 1833.

Frustules in long filaments, usually united in twos by a connective zone, not keeled. In zone view the puncta on the valves, about 20 in 10 μ, are in somewhat irregular lines and on the connective zone larger, about 15 in 10 μ, in longitudinal and transverse rows, the transverse often two together Valves circular, very convex, with hyaline centre and puncta in partly radiating, mostly irregular, short lines, with larger puncta scattered here and there. Diam. of v. 25–50 μ. Sporangial frustules larger, to 70 μ.

Type locality Europe

Distribution Marine and brackish. Atlantic coast.

Illustrations W Smith, Syn Brit Diat 2 pl. 50, f. 1, Van Heurck, Syn. Diat. Belg pl 85, f. 5–7, Boyer, Diat. Phila. pl. 1, f 7 (as *Lysigonium moniliforme* (Müll) Link).

For discussion of synonymy see W Smith, Syn Brit Diat 2 56 and Agardh, Consp Crit 65

5 **Meloseira Juergensii** Ag., Syst Alg 9. 1824.

Frustules in filaments, usually geminate, united by connective zone, cylindrical, slender. Valves convex, finely punctate, appearing hyaline, slightly constricted near the suture Diam of v 10–20 µ. Auxospores twice the size

Type locality Europe

Distribution Brackish and marine. West Indies (Oestrup)

Illustrations: Kütz Bac pl 2, f 15, Van Heurck, Syn Diat Belg. pl 86, f. 1–3, 5–8 H L Smith, T S 225

6 **Meloseira varians** Ag., Consp. Crit Diat. 64. 1832

Frustules oblong in long filaments or united in twos by a connective zone Puncta subtle, 20 in 10 µ, in longitudinal, transverse and, under certain illumination, oblique rows Valves slightly convex, with minute puncta in radiating lines and often with a few scattered, larger puncta Diam. of v 15–35 µ Sporangial frustules globose, much larger Chromatophores in oblong, rounded or irregular, flat granules along the wall of the cell

Type locality: Europe.

Distribution Fresh water, in springs and ditches. Common

Illustrations. Kütz Bac. pl 2, f 10, W Smith, Syn. Brit Diat. 2. pl 51, f 332, Van Heurck, Syn Diat Belg pl 85, f 10–15, Boyer, Diat Phila. pl 1, f 18, 19 (as *Lysigonium*), H. L. Smith, T S 234

As Peragallo remarks (Diat. Fr, 447) *M. varians* and *M juergensii* differ chiefly in habitat.

7 **Meloseira roeseana** Rab, Suess Diat. 13 1853

Orthosira spinosa Grev Ann Mag Nat Hist (2) 15 8 1855

Frustules constricted near the valve surface, with coarse, longitudinal striae. Valves convex, with punctate, radiating striae disappearing toward the centre which contains several large granules. Connective zone with longitudinal lines of puncta 21 in 10 µ Diam of v. 12–45 µ

Type locality: Saxony.

Distribution Fresh water Media, Penna Local

Illustrations Rab. Suess. Diat. Suppl pl 10, f 5; Ann Mag. Nat Hist (2) 15 pl 4, f. 14–17, W. Smith, Syn. Brit Diat. 2 pl 61, f 386, Van Heurck, Syn Diat Belg pl. 89, f 1–6; Boyer, Diat Phila pl 1, f 5, 6; A Schmidt, Atlas, pl. 176, f. 7–14

8 **Meloseira epidendron** (Ehrenb) Boyer

Stephanosira Epidendron Ehrenb Abh Akad Berlin 1871 pl 2
Meloseira Roseeana Epidendron Grun in Van Heurck, Syn Diat Belg pl 89 1881

Frustules constricted near the valve surface, denticulate at the margin, not striated, but with longitudinal and oblique lines of puncta about 16 in 10 µ Valves convex, with radiating punctate lines Centre hyaline, with several large granules Diam of v 20–30 µ.

Type locality† Venezuela, on trees

Distribution Fresh water. Wissahickon, Philadelphia, on *Marchantia* and mosses Local

Illustrations Van Heurck, Syn Diat Belg pl 89, f 17, 18, Boyer, Diat Phila pl 1, f 3, 4

9. **Meloseira undulata** (Ehrenb) Kütz Bac 54 1844.

Gallionella undulata Ehrenb Ber Akad Berlin, 1840 17
Meloseira Gowenii A Schmidt, Atlas, pl 177 1893

Frustules usually solitary or in twos with valves of opposite frustules united, usually broader than long, constricted near the margin Valves with six to twelve internal projections forming with the outline of the constriction of the valve a polygonal figure with the circumference Surface of the valve with radiating lines of puncta disappearing toward the centre at which are numerous coarse granules Diam of v to 75 µ.

Type locality Europe

Distribution Fresh and brackish water Delaware River; Connecticut

Illustrations Ehrenb. Mikrogeol pl 12, f 9; Kütz. Bac. pl 2, f 9, Van Heurck, Syn Diat. Belg pl. 90, f 8, 9, Ber Deuts Bot Ges. 8 pl 19, f. 1–13. 1890, A. Schmidt, Atlas, pl 176, f. 4–6, Boyer, Diat. Phila , pl. 1, f. 15–17.

10 **Meloseira sol** (Ehrenb) Kütz , Sp. Alg 31 1849.

Gallionella Sol Ehrenb Ber Akad Berlin 1844 202
Cyclotella radiata Brightw Quart Jour Micr Sci 8 76 1860

Frustules in filaments, disc-shaped, with longitudinal rows of fine puncta Valves plane, hyaline at the centre, with coarse costate rays, about 5 in 10 µ. Diam. of v. about 45 µ.

Type locality Antarctic Sea

Distribution Marine Panama, Pacific coast.

Illustrations. Ehrenb Mikrogeol. pl. 35, 22, f 12, Quart Jour Micr Sci 8. pl 6, f 11, Van Heurck, Syn Diat Belg pl 91, f. 7–9, H L Smith, T S 640

11 **Meloseira crenulata** (Ehrenb) Kütz Bac 55 1844
Gallionella crenulata Ehrenb Abh Akad Berlin 1843 pl 2
Orthosira orichalcea W Smith, Syn Brit Diat 2 61 1856

Frustules cylindric, usually two or three times longer than the diameter, denticulate at their junction, with a narrow furrow on each side of the suture Puncta in irregular, transverse or oblique rows, 18 in 10 μ, sometimes coarser Valves with fine puncta scattered at the centre, radiate at the circumference

Type locality Europe

Distribution. Fresh water, in springs and ditches Common

Illustrations Van Heurck, Syn Diat Belg pl 88, f 3, 4, Boyer, Diat Phila pl 1, f 1, 2

Meloseira crenulata semilaevis Grun in Van Heurck, Syn Diat Belg. pl 88, f 18 This undescribed form is illustrated as having but half of each valve striated It is reported from "Bottina Creek," Fla I have not seen any authentic specimens, but at Tocoi Springs, Fla occurs, rather abundantly, a form of *M crenulata* in which many of the frustules enclose one or two other frustules with the same outline as those figured, which are convex and hyaline at the ends Frustules like these, two together, but never more, are found free Whether these are sporangial or not is difficult to determine but in any case they are found in otherwise normal filaments of *M crenulata*

Gaillonella aurichalcea Bailey, (Am Jour Sci 41 90. 1841) is probably not the same as *Orthosira orichalcea* W Smith Bailey's figures, pl 2, a, b, do not agree, although figure c shows the auxospore, and there is no indication of crenulation on the margin The number of synonyms which might be assigned to this form indicates the variations existing in the species

12 **Meloseira crotonensis** (Bail) H L Smith T S 678 1876
Gallionella crotonensis Bail Smith Contr 7. 9 1854
Meloseira crenulata italica (Kütz) Grun in Van Heurck, Syn Diat Belg pl 88 1881
Meloseira tenuis Van Heurck, Syn Diat Belg pl 88 1881

Frustules cylindric, slender, two to six times longer than the diameter. Furrows near the suture evident Margin denticulate but less so than in *M crenulata* Puncta usually in decussate or irregular, curved lines Diam of v 5 μ or more

Type locality Croton River, N Y

Distribution Fresh water Lake Erie. Croton River, N Y.

Illustrations Van Heurck, Syn. Diat Belg pl 88, f 7, 9

13 **Meloseira distans (Ehrenb.) Kütz, Bac. 54 1844.**

Gallionella distans Ehrenb. Inf 170 1838
Coscinodiscus minor W Smith, Syn Brit 1 23 1853
Meloseira nivalis W Smith, Syn Brit Diat 2 58 1856

Frustules slender, with a furrow on each side of the suture forming a hyaline band Puncta in longitudinal rows, 14 in 10 μ. Valves in valve view with scattered puncta. Diam of v. 7–10 μ.

Type locality. Europe.

Distribution Fresh water, in springs and ditches. Common

Illustrations. Van Heurck, Syn Diat Belg pl. 86, f. 17–23, Boyer, Diat Phila. pl 1, f. 8, 9

14. **Meloseira granulata (Ehrenb.) Ralfs in Prit. Inf 820 1861**

Gallionella granulata Ehrenb Abh Akad Berlin 1843 127
Orthosira punctata W Smith, Syn Brit. Diat 2 62 1856

Frustules cylindric, robust, the slender forms elongated, the larger quadrangular. Puncta in coarse granules in longitudinal transverse, sometimes spiral lines, 7–9 in 10 μ Valves in valve view with scattered puncta and coarsely denticulate on the margin Diam. of v 5–18 μ

Type locality Europe

Distribution Fresh water, in springs and ditches Common.

Illustrations W. Smith, Syn Brit Diat 2 pl 53, f 339, Van Heurck, Syn Diat Belg pl. 87, f 10–12, Boyer, Diat Phila pl 1, f. 10.

The distinctions between *M. crenulata*, *M. distans* and *M. granulata* are graduated so imperceptibly that it is difficult, in some cases, to identify them. Variations occur in the width of furrows, or their absence, in the denticulation, and in the coarseness of puncta which are not always arranged in the same manner in contiguous frustules.

2 PODOSIRA Ehrenb. Ber Akad Berlin 1840 161 1840

Frustules spheric or cylindric, solitary, geminate or ternate, stipitate. Valves circular, convex, finely punctate Chromatophores granular, except in *P. hormoides*, in which, as stated by Petit, the chromatophore consists of a single plate, four-lobed, in contact with one valve.

Type species, *Podosira nummuloides* Ehrenb.

Puncta in radiating lines	1 *P montagnei*
Puncta in radiating, fasciculate lines	2 *P. hormoides*
Puncta in fasciculate and oblique rows.	3 *P. arctica*
Puncta in decussating, oblique rows	4. *P maxima*
Puncta subtle, radiating	5 *P febigerii*
Puncta fine, radiating, circular band with oval markings	6 *P argus*

1 **Podosira montagnei** Kütz, Bac 52 1844

Frustules oblong, rounded Valves circular Markings minute puncta in radiating lines in valve view and in parallel lines in zone view. Border well defined, striated, the striae about 20 in 10 μ. Diam of v 45 μ

Type locality West Indies

Distribution Marine Atlantic Ocean

Illustrations Kütz Bac pl 29, f 85, Van Heurck, Syn Diat. Belg pl 84, f 11, 12

2 **Podosira hormoides** (Mont) Kütz Bac. 52 1844

Melosira hormoides Mont Fl. Boliv 2 1839
Podosira nummuloides Ehrenb Ber Akad Berlin 1839 158 1839
Podosira moniliformis Ehrenb Abh Akad Berlin 1843 pl 1 1843
Hyalodiscus hormoides P Petit, Fonds Mer 3 172 1877

Frustules compressed in zone view, concatenate, two or more, in short chains Valves circular, convex Markings minute puncta in radiating, fasciculate lines, about 18 in 10 μ Minute hyaline interspaces at the origin of the shorter rows giving the appearance of dark puncta scattered over the valve Border striated Diam. of v to 45 μ.

Type locality Peruvian coast.

Distribution Marine Cuba

Illustrations Kütz Bac pl. 28, f. 5, a, b, c, pl. 29, f. 84, A Schmidt, Jahresb Komm Unters. Meere II Diat pl 3, f. 40; Jour Roy. Micr Soc, 2 pl. 21, f. 7; Van Heurck, Syn Diat Belg pl 84, f 3, H. L. Smith, T S 419

3 **Podosira arctica** (Cleve) Cleve & Grun., Sv Vet.-Akad. Handl. (2) 17^2: 118. 1880.

Hyalodiscus arcticus Cleve, Cleve & Grun Sv Vet.-Akad Handl (2) 17^2: 118, as synonym 1880

Puncta about 20 in 10 μ, the rows scarcely fasciculate and the oblique decussating rows more evident. Border narrow, striated Diam. of v. 75 μ. Description from a specimen from Spitzbergen

Type locality Spitzbergen.

Distribution Marine. Arctic Sea

4. **Podosira maxima** (Kütz) Grun., Cleve & Grun. Sv Vet.-Akad Handl. (2) 17^2 118 1880

Cyclotella maxima Kütz Bac. 50 1844.

Central space absent or minute, with numerous hyaline interspaces appearing as apiculi and forming a dark central area of radiating lines Surface flat to semi-radius and gradually descending to the border Markings punctate, 15 in 10 μ at centre, decreasing at the border to 18 in 10 μ, in irregular, radiating lines Border narrow, striated Apiculi indistinct or absent. Punctate markings in decussating, oblique rows as in *Hyalodiscus subtilis*, and apparent apiculate markings due to the numerous hyaline interspaces at the origin of secondary rows resembling those of *Hyalodiscus radiatus* Diam of v to 145 μ

Type locality Coast of Peru

Distribution Marine Pacific coast, Colon

Illustrations Kütz Bac pl 1, f 5, Jour. Roy Micr Soc 1879 2. pl. 21, f 2, H L Smith, T S. 421

Podosira maxima californica Grun , Cleve & Grun Sv Vet-Akad Handl (2) 17^2 118 1880 *Actinocyclus interpunctatus* H L Smith, Type Slide 12 Valves circular, convex Markings irregular at centre, sometimes forming a small umbilicus, thence radiating in nearly straight lines, about 12 in 10 μ at the centre, to 15 in 10 μ near the border Minute hyaline interspaces at the origin of the shorter rows, producing the appearance of dark spines. Oblique decussating rows evident Border narrow, striated, divided into an outer and inner more hyaline part by a distinct line. Diam of v. 150–230 μ Marine Pacific coast This form cannot be considered an *Actinocyclus*, having no nodule (Rattray, Jour Quek Club. Ser 2, 4 203 1890)

5 **Podosira febigerii** Grun , Cleve & Grun , Sv Vet. Akad Handl (2) 17^2 119 1880

Frustules usually geminate, surrounded by a delicate connective membrane Valves circular, convex. Markings punctate, subtle, 27 in 10 μ, radiating Border narrow Diam of v 20–40 μ

Distinguished from *P. hormoides* by its smaller size and finer markings, the valves appearing hyaline under ordinary illumination.

Type locality California.

Distribution. Marine. Known only from the type locality.

Illustrations Van Heurck, Syn Diat. Belg pl 84, f. 22-24.

6 **Podosira argus** Grun , in O Schneider Nat Beitr Kauk 132 1878

Podosira pacifica H H. Chase, Walker & Chase, Notes Diat 1 5. 1886
Podosira variegata A Schmidt, Atlas, pl 140, f 3

Valves with fine radiating striae, 16 in 10 μ. A circular band, about one-third the diameter of the valve in width, between centre and border, with several concentric rows of large oval markings Border wide, coarsely striated. Diam. of v 95–107 μ.

Type locality Monterey, California.

Distribution. Marine. Pacific Ocean soundings.

Illustrations Jour Roy Micr Soc 2 1879 pl 21, f 6, Walker & Chase, Notes Diat pl 1, f 5

3 HYALODISCUS Ehrenb. Ber Akad Berlin 1845 78 1845

Frustules cylindric, compressed, free Valves circular, convex, with a central umbilicus, granulated and usually irregular in outline, from which radiate punctate markings in decussating, oblique rows

Hyalodiscus and *Podosira* are closely connected but the former has always a distinct umbilicus while the latter seldom has the rudiments of one The chromatophores in the two genera appear to differ

Type species, *Hyalodiscus laevis* (Kütz) Ehrenb

Puncta in radiating decussating rows, very subtle, umbilicus one-third the diameter	1 *H subtilis*
Puncta in radiating interrupted lines, umbilicus two-thirds the diameter	2 *H whitneyi*
Puncta subtle, in radiating decussating rows, umbilicus larger in proportion than in *H subtilis*	3 *H scoticus*
Puncta in oblique decussating lines forming numerous sectors	4 *H stelliger*
Puncta radiating, with minute interspaces appearing as dark spines	5 *H radiatus*

1 **Hyalodiscus subtilis** Bailey Smith Contr 7 10 1853

Valves circular Surface convex Umbilicus central, yellowish brown, with irregular or fimbriate border, granulated, the granules 8–10 in 10 µ, irregular From the border of the umbilicus radiate lines, decussating in oblique, curved rows of fine puncta, 24–26 in 10 µ, near the umbilicus, 30 in 10 µ at the border, invisible under ordinary illumination Diam of v variable, to 115 µ The umbilicus is usually about one-third the diameter but is variable. Chromatophores, according to Mereschkowsky, are in the form of numerous rods, which lie in a row and are not bound in the centre.

Hyalodiscus californicus Bailey (Am Jour Micr 3 247 1878) is considered by H L Smith to be the same as *H subtilis* See discussion by F Kitton and reply as in the above

Type locality Halifax, Nova Scotia

Distribution. Marine North Atlantic. Pacific coast.

Illustrations Bailey, Smith. Contr 7. pl., f 12, Ralfs, in Prit. Inf. (1861), pl. 5, f. 60, H L Smith, T S 201.

2 **Hyalodiscus whitneyi** Ehrenb., Abh Akad Berlin 1870 57 1870.

Valves with central umbilicus two-thirds the diameter, the granules radiating in interrupted lines Border 2 μ in width, finely straiated. Diam. of v 100 μ. Differs from *H. subtilis* in the width of the border

Type locality Salt Lake, Utah.

Distribution Known only from the type locality

Illustrations. Abh Akad Berlin 1870. pl 2, 1, f 21

3 **Hyalodiscus scoticus** (Kütz.) Grun Jour Roy Micr Soc 2 600 1879

Cyclotella scotica Kütz Bac 50 1844
Podosira hormloides W Smith, Syn Brit Diat 2 53 1856
Not *Podosira hormoides* Kütz

Valves as in *H. subtilis* but with diam about 25 μ or less and the umbilicus usually relatively larger Chromatophores in four patches "bound together by a common pyrenoid"

Type locality Scotland

Distribution Marine. Atlantic coast Arctic Sea.

Illustrations Jour. Roy. Micr. Soc 2 1879, pl 21, f. 5, a and b, Van Heurck, Syn. Diat. Belg pl. 84, f 15–18, W Smith, Syn. Brit Diat. 2. pl 49, f. 327, Boyer, Diat Phila. pl 1, f 20

4 **Hyalodiscus stelliger** Bailey, Smith Contr 7 10 1853

Podosira maculata W. Smith, Syn Brit Diat 2 54 1856
Hyalodiscus maculatus Cleve, Bih Sv Vet-Akad Handl 5^{8}· 18 1876

Valves circular, convex. Umbilicus irregular, with scattered, coarse puncta Markings punctate, the puncta, 16 in 10 μ, in oblique, decussating lines which, by reason of the difference in obliquity, form numerous sectors, the minute hyaline interspaces between them producing an appearance of rays Border broad, striated. Diam. of v 35–85 μ.

Type locality Coast of Florida.

Distribution. Marine Atlantic coast West Indies, Campeche Bay

Illustrations· Van Heurck, Syn Diat Belg. pl. 84, f. 1, 2; W. Smith, Syn. Brit. Diat. 2: pl. 49, f. 328; Boyer, Diat Phila pl. 1, f. 22.

5 **Hyalodiscus radiatus arcticus** Grun, Denks. Akad Wien 48: 93 1884.

Valves circular, convex. Markings 17 in 10 μ, radiating puncta with numerous minute hyaline interspaces at irregular intervals, appearing as dark spines. Border wide, striated Diam. of v. 60–70 μ. Differs from the type form from Kerguelen Land in its finer striation

Type locality· Arctic Sea.

Distribution: Marine and brackish. Delaware River.

Illustrations. Denks. Akad Wien 48 pl. 5 (E), f. 37; Boyer, Diat. Phila. pl. 1, f 21.

4. **STEPHANOPYXIS** Ehrenb. Ber Akad Berlin 1844 264. 1844

Frustules ellipsoid, concatenate. Valves tumid, of unequal convexity, coarsely areolate, the hexagonal cells in rows parallel to the longitudinal axis of the frustule, not radiate, with spines, more or less concentric, near the margin Chromatophores round or angular discs near the connective zone

Type species, *Pyxidicula aculeata* Ehrenb

Spines on the margin in a single row, dilated at their summits 1 *S corona*
Spines variable in number, near the margin 2. *S turris*

1 **Stephanopyxis corona** (Ehrenb) Grun, Van Heurck, Syn Diat. Belg pl 83 ter 1881
Systephania corona Ehrenb Ber Akad Berlin 1844 272 1844

Valves unequal. One valve convex, areolate, the areolae hexagonal, in quincunxes, in parallel rows, 4–5 in 10 µ At the margin a row of long spines dilated at their summits into the shape of the letter T and usually united The other valve more convex, with long spines concentrically arranged Diam of v 84 µ

Type locality Miocene deposits

Distribution Marine Pacific coast, East River, New York.

Illustrations Van Heurck, Syn. Diat. Belg pl 83 ter, f. 10, 11; A Schmidt, Atlas, pl. 123, f 10–17, Boyer, Diat. Phila. pl 2, f 3.

It is doubtful whether this species should be included among living forms, as the specimens found were dead valves, and may have come from fossil deposits It is common in the miocene of the Atlantic and Pacific coasts

2 **Stephanopyxis turris** (Greg.) Ralfs, in Prit., Inf 826 1861
Cresswellia Turris Greg Trans Roy Soc Edinb 21 538 1857
Stephanopyxis appendiculata Ehrenb Mikrogeol *pl 18, f 4?* 1854
Pyxidicula appendiculata Kütz Sp Alg 22 1849

Valves cylindric, convex, areolate, the areolae about 2 in 10 µ, hexagonal, sometimes punctate, in rows parallel to the longitudinal axis of the frustule. A crown of spines, 10–24 in 10 µ, variable in length and thickness, near the margin The valve with the greater convexity usually has stouter spines but not so many of them as the other valve. Diam. of v. 30–50 µ.

Type locality. England

Distribution· Marine. Atlantic and Pacific coasts.

Illustrations: Trans. Roy. Soc. Edinb. 21 pl. 14, f. 109; Prit. Inf. pl. 5, f. 74; A. Schmidt, Atlas, pl 130, f. 42, 43, Boyer, Diat. Phila. pl. 2, f. 1, 2

Stephanopyxis turris cylindrus f *inermis* Grun Denks. Akad. Wien 48 87 pl 5, f 10–13 1884. Length of frustule 50 µ. Cells 5 in 10 µ Savannah, Ga.

Stephanopyxis turris intermedia Grun Denks Akad Wien. 48· 88. pl 5, f 15, 16 1884 Diam of v 32 µ Spines short and slender Cells about 4 in 10 µ Behring Sea

Stephanopyxis turris minor Grun Denks Akad Wien 48 88 Valves 25–40 µ in diam Spines 8–14. Cells 3½–4 in 10 µ Atlantic Ocean near New York

Intermediate variations occur, but more especially in the fossil deposits of Nottingham and Barbados.

(b) COSCINODISCINAE

1 *Cyclotella.* Frustules solitary or geminate, with two concentric divisions of different structure, a wide border and an undulate surface

2 *Coscinodiscus* Frustules solitary. Valves disc-shaped, areolate or punctate, with a narrow border. Margin without spines, sometimes with apiculi

3 *Stephanodiscus* Frustules usually solitary Valves circular, with radiating rows of granules Margin usually with a crown of spines

4 *Thalassiosira.* Frustules in long chains connected by mucous threads from the centre of the valves

5 *Skeletonema* Frustules in chains connected by numerous thread-like processes from the borders of the valves

Cyclotella and *Coscinodiscus* are closely united *Stephanodiscus* is similar to *Coscinodiscus* and resembles in its spines certain forms of the latter with prominent apiculi *Thalassiosira* is in frustules connected by single threads which replace spines and *Skeletonema* differs more in the remarkable development of the marginal spines into siliceous threads resembling processes The Meloseirinae and Coscinodiscinae are connected through the genus *Stephanopyxis.*

5. CYCLOTELLA (Kütz.) Bréb, Consid Diat. 19 1838.

Frustulia sect (*a*) *Cyclotella* Kütz Linnaea 8 535 1833

Frustules single or geminate, cylindrical, discoid; in zone view rectangular or with undulating sides. Valves divided into a central surface and a wide border. The centre sometimes bullose, hyaline, or with fine, radiating lines and scattered puncta. Border striated or costate Chromatophores numerous, along the valves.

Type species, *Frustulia operculata* Ag

Central space flat, coarsely punctate Margin coarsely striated, the striae forming quadrangular cells	1. *C stylorum*
Central space bullose, indistinctly punctate Margin striated, the striae disappearing toward the centre	2 *C striata*
Central space undulate, indistinctly punctate and striated Margin coarsely striated	3 *C quillensis*
Central space undulate, minutely punctate Margin coarsely striated, the striae transversely punctate	4 *C. meneghiniana*
Central space undulate, with scattered puncta Margin finely striated	5 *C kutzingiana*
Central space undulate or inflated, nearly smooth Margin with short striae alternating with apparent spines.	6 *C operculata*
Central space convex, with cuneate, converging cells	7 *C antiqua*
Central space slightly inflated, with irregular puncta Margin closely striated, with an intramarginal zone	8 *C comta*
Central space flat, with radiating puncta Several spines on the inner edge of border	9 *C. bodanica*

1 **Cyclotella stylorum** (Brightw ?) Van Heurck Syn Diat Belg pl 92 1881

Cyclotella stylorum Brightw ? Quart Jour Micr Sci 8 96 1860

Central part of valve coarsely punctate, frequently surrounded by more prominent puncta Margin striated, the alternate or each third stria outside of the intramarginal line more emphasized than the others, producing a quadrate cellular appearance on the margin Diam of v 20 µ

Type locality Sierra Leone?

Distribution Marine and brackish Atlantic coast

Illustrations Brightw, Quart Jour Micr. Sci. 8 pl 6, f 16? Van Heurck, Syn Diat Belg, pl 92, f, 2, 3, Boyer, Diat. Philadelphia, pl. 2, f 10

2 **Cyclotella striata** (Kütz) Grun , Cleve & Grun Sv Vet -Akad Handl II 17^2 110 1880

Coscinodiscus striatus Kütz , Bac , 131 1844.

Cyclotella Dallasiana W Smith, Syn. Brit. Diat. 2 87 1856

Central part of valve bullose, coarsely but usually indistinctly punctate. Margin striated, the striae, 6–12 in 10 µ, disappearing toward the centre Diam of v 30–80 µ Numerous variations occur in the coarseness and visibility of the central puncta and in the length and fineness of the striae

Type locality Cuxhaven

Distribution Marine and brackish. Aestuaries of the Atlantic coast.

Illustrations· Kütz., Bac., pl. 1, f. 8; Van Heurck, Syn. Diat. Belg., pl. 92, f. 6–10; Boyer, Diat. Philadelphia, pl. 2, f 9

3 **Cyclotella quillensis** L. W Bail., Contr Can Biol, 159. 1922

Frustules undulating in zone view. Valves with border about one-fifth the radius, coarsely striated, the striae 6–7 in 10 μ, indistinctly punctate. Central area with indistinct radiating lines disappearing toward the centre and with a few scattered, indistinct granules Diam usually about 60 μ. This form appears to be a variation of *C. striata*.

Type locality Big and Little Quill Lakes, Saskatchewan, Can.

Distribution. Slightly brackish water Known only from the type locality.

Illustrations. L. W. Bail, Contr Can Biol pl 1, f 1. 1922.

4 **Cyclotella meneghiniana** Kütz Bac, 50 1844

Cyclotella Kutzingiana W Smith, Syn Brit Diat, 1 27 1853

Frustules rectangular, slightly undulated in zone view. Central part of valve minutely punctate, the puncta, scarcely visible, in radiating lines. Margin well defined, coarsely striated, the striae transversely punctate. Diam of v. 10–20 μ

Type locality Europe.

Habitat Fresh water Common

Illustrations Kütz, Bac., pl. 30, f 68, Van Heurck, Syn. Diat. Belg., pl. 94, f. 11; Boyer, Diat. Philadelphia, pl 2, f. 8

Cyclotella meneghiniana stelligera Cleve & Grun, Cleve, Sv Vet-Akad Handl. (2) 18 22 pl 5, f. 63, c 1881, Van Heurck, Syn Diat. Belg, pl 94, f. 22; Boyer, Diat Philadelphia, pl. 2, f 4 Margin with striae 14–16 in 10 μ Central space with radiating lines of unequal length. Diam. of v 7–22 μ Fresh water. Local. Media, Penna. (Coll T C Palmer.)

Cyclotella meneghiniana stellulifera Cleve & Grun., Cleve, Sv. Vet-Akad. Handl (2) 18 · 22. pl 5, f 63, b. 1881, Van Heurck, Syn. Diat Belg, pl 94, f 21, Boyer, Diat Philadelphia, pl 2, f 12. As in var. *stelligera* but with the central space with radiating granules. Fresh water. Local. Media, Penna (Coll. T. C. Palmer)

5 **Cyclotella kutzingiana** Thw, Ann Mag Nat Hist., 8: 169. 1848.

Frustules in zone view angular, undulate. Central part of valve punctate, the puncta scattered. Margin striated, the striae 12–14 in 10 μ. Diam of v 12–30 μ. The central part is frequently not circular and the striae are sometimes oblique.

Type locality England

Distribution Brackish (and fresh?) water Atlantic coast

Illustrations: Van Heurck, Syn Diat. Belg., pl 94, f. 1, 4.

This is not *Cyclotella kutzingiana* W Smith There is much confusion as to the identity of *C. meneghiniana* and C *kutzingiana* In the former the striae are transversely punctate.

6 **Cyclotella operculata (Ag) Bréb., Consid Diat 20. 1838.**

Frustulia operculata Ag Flora 10' 627 1827
Cymbella operculata Ag Consp Crit Diat, 11 1830

Frustules in zone view undulating or with inflated valves, according to position Valves circular, convex on one part, depressed on the other. Central part nearly smooth or finely punctate Margin striated, the striae short, alternating with minute spines Diam of v. 12–50 μ.

The convexity of one valve is opposite the depression of the other and, consequently, in zone view the inflations of the two valves appear in a plane at right angles to that which shows the undulations. The angles also appear more rounded when the inflations are in view than when the undulations are seen This difference may account for the numerous variations in the figures of authors. The species is sometimes confused with C *striata* (Kütz.) Grun which is a brackish form

Type locality Europe

Distribution Fresh water, in pools and on wet rocks Not common. Boston, Mass (H L. Smith)

Illustrations W Smith, Syn. Brit Diat 1 pl 5, f 48, Brun. Diat Alpes pl 1, f 14, Van Heurck, Syn Diat Belg pl 93, f 22, Boyer, Diat Phila. pl 2, f 5, 6, H. L Smith, T S 106, 107

7 **Cyclotella antiqua W Smith Syn. Brit Diat 1 28 1853**

Frustules rectangular showing distinct cellular structure of the margin of the valves Valves with convex surface Margin finely striated. On a secondary layer the margin is divided into quadrate cells, their border giving the appearance of short spines among the striae. In the centre are from 5–12 cuneate cells converging. Central surface distinctly punctate (under immersion). Diam. of v. 15–30 μ

Type locality England.

Distribution Fresh water. Local Abundant in Black River, Mich.

Illustrations W. Smith, Syn. Brit. Diat, 1 pl 5, f. 49, Van Heurck, Syn. Diat Belg, pl 92, f 1, Boyer, Diat Philadelphia, pl. 2, f. 11.

8 **Cyclotella comta** (Ehrenb) Kütz, Sp Alg 20 1849

Discoplea comta Ehrenb Ber Akad Berlin, 267, 1844 The numerous figures in Mikrogeologie, pl 38, fail to show, as Ralfs remarks, the granulations of the central part

Frustules not undulate, slightly inflated in zone view Central part of valve punctate, the puncta irregular at the centre, thence radiating, with hyaline interspaces Margin closely striated, the striae lineate, with an intramarginal zone, apparently cellular, producing an appearance of spines Diam of v. to 35 μ Numerous variations occur, the smaller valves showing the puncta more scattered in the centre

Type locality Kurdistan

Distribution Fresh water Local Lake Michigan, New England

Illustrations Van Heurck, Syn Diat Belg, pl 92, f 16–22, Boyer, Diat Philadelphia, pl 2, f 7

9 **Cyclotella bodanica** Eul in Grun Schneider's Naturwiss. Beitr z Kennt d Kaukasusländer 120 1878

Valves with plane surface Central part with radiating puncta. Border broad, about half the radius in width, with rays 11 in 10 μ On the inner edge of the border several prominent spines Diam 26–60 μ.

Type locality Lake Constance

Distribution Fresh water Tontine Lake, New Brunswick, Morin Heights, near Montreal (Coll H C Wheeler), British Columbia

Illustrations Van Heurck, Syn. Diat. Belg, pl 93, f 10

Species Reported

Cyclotella regina Mann Contr U S. Nat Herb 10^4 265 pl 50 f 2 1907

Surface of valve flat, central area three-fourths the diameter, with a few scattered puncta Border divided into two parts by a fine line, with striae about 15 (?) in 10 μ (ex icone) Diam of v 88 μ Gulf of California

6 **COSCINODISCUS** Ehrenb, Abh Akad Berlin 1838 128 1838

Frustules solitary, cylindrical, compressed Valves circular or elliptical, with flat, concave or convex, sometimes undulating surface Markings angular, usually radiating, sometimes in fasciculate rows or granular, either radiating or irregular. Central space, if present, hyaline, sometimes surrounded by a rosette of large cells Chromatophores round, angular or irregular discs, usually without pyrenoids Reproduction not determined but there are indications that internal spores occur.

The general structure is that of certain forms of *Biddulphia*, such as *B. favus*. A triangular form, known as *Triceratium coscinoides* Grove and Sturt, found in Miocene deposits, appears to connect the two genera

Type species, *Coscinodiscus radiatus* Ehrenb

The following arrangement is partly that of Rattray (Proc Roy. Soc Edinb 16 1890) and, in many cases, Rattray's measurements are adopted

1 Nitidi Markings punctate or granular, irregular
2. Lineati Pant. Markings in parallel, curved or irregular rows.
3 Subtiles Markings in radial, fasciculate rows
4 Radiati Markings in more or less radial, non-fasciculate rows.

NITIDI

Markings larger at centre, irregular or in short rows.	1	*C confusus*
Markings slightly larger and closer at the centre	2	*C granulosus*
Markings decreasing to the border at which are interfasciculate rows	3	*C nitidus*
Markings scattered in the centre, decreasing to the border Valves often irregular in outline .	4	*C nitidulus*
Markings without order. Central space elongated Valves subelliptical.	5	*C cocconeiformis*

1 **Coscinodiscus confusus** Rattray Proc. Roy Soc Edin 16 3 1890

Central space small Markings granular, larger at the centre, irregular or in short rows Border distinct, hyaline Diam of v. 53 μ

Type locality Campeche Bay

Distribution Marine Known only from the type locality

Illustrations A Schmidt, Atlas, pl 64, f 15

2 **Coscinodiscus granulosus** Grun., Cleve & Grun , Sv Vet.-Akad Handl II 17^3 113 1880

Central space absent. Markings granular, larger and closer at the centre Apiculi at the border minute, 3 in 10 μ Border distinct, with striae 17 in 10 μ Diam. of v 16–33 μ.

Type locality Finmark.

Distribution Marine Greenland.

Illustrations Rattray, Proc. Roy Soc Edin 16 pl 1, f 23

Coscinodiscus granulosus conspicuous Rattray, Proc. Roy. Soc. Edin 16 6. Markings more numerous than in the type, indistinct. Border striae distinct, 12 in 10 μ. Apiculi about 2 in 10 μ, prominent, about 5 μ in length Diam of v 49–53 μ Campeche Bay. A Schmidt, Atlas, pl 57, f 3

3 **Coscinodiscus nitidus** Greg, Trans. Roy Soc Edin 21^4 499 1857

Valves circular or nearly so Surface flat Central space absent. Markings rounded, with central dots, 3 in 10 μ at the centre, decreasing in interfasciculate rows to 4 in 10 μ, at the border 6 in 10 μ, in short rows of two granules each Border very narrow Diam. of v 70 μ.

Type locality: Scotland.

Distribution Marine Atlantic and Pacific Coasts.

Illustrations. Greg, Trans. Roy Soc Edin 21^4 pl. 10, f. 45; Pritchard, Infusoria (1861), pl. 8, f 18, A Schmidt, Atlas, pl 58, f 18; Boyer, Diat. Philadelphia, pl. 2, f. 18.

Coscinodiscus nitidus sparsus Rattray, Proc Roy Soc Edin. 16 31 1890. Markings with wider interspaces than in type. Campeche Bay. A Schmidt, Atlas, pl 58, f 17

Coscinodiscus nitidus tenuis Rattray, Proc Roy Soc Edin 16. 31 1890 Markings smaller than in type, punctiform, "in a narrow band adjacent to the border." Campeche Bay A Schmidt, Atlas, pl. 58, f 19

4 **Coscinodiscus nitidulus** Grun; A. Schmidt, Atlas, pl. 58 1876

Valves circular, irregular or sometimes subtriangular Surface flat Central space absent Markings scattered in the centre, 4 in 10 μ, radiating, slightly decreasing in more or less fasciculate rows, with hyaline interspaces, to the border, where the striae are about 8 in 10 μ Diam. of v. 25 μ Differs from *C nitidus* in the more uniform size of the markings and in the fasciculate rows but specimens occur intermediate between the two species

Type locality: Campeche Bay.

Distribution Marine and brackish Atlantic Coast

Illustrations: Van Heurck, Syn. Diat. Belg., pl 132, f 2, A. Schmidt, Atlas, pl 58, f 20, 21; Boyer, Diat Philadelphia, pl. 2, f. 19.

5 **Coscinodiscus cocconeiformis** A. Schmidt, Atlas pl 58 1878

Valves subelliptical, with flat surface. A broad hyaline space extends along the major axis reaching the marginal band On each side of this space are granules without order At the border a band of radiating rows of two or three granules each. Quite variable. Diam 20–35 μ

Type locality. Monterey, Cal.

Distribution Marine. Campeche Bay.

Illustrations. A. Schmidt, Atlas, pl. 58, f. 25

Coscinodiscus cocconeiformis latior Rattray, Proc. Roy Soc. Edin. 16: 151. 1890. The hyaline band constricted and the band at the border absent. Campeche Bay A Schmidt, Atlas, pl 58, f. 23.

LINEATI (Part)

Markings in oblique decussating rows concave to the border, 4 in 10 μ at centre, 8 at the border.	6. *C excentricus*
Markings in oblique decussating rows A row of granules at the border	7. *C. pustulatus*
Markings slightly concave to the border, 5–6 in 10 μ at the centre, 10 in 10 μ at the border	8 *C minor*
Markings in straight or nearly straight parallel rows	9. *C lineatus*
Markings in oblique decussating, rows, 5 in 10 μ at the centre, suddenly decreasing to 15 in 10 μ at the border.	10 *C sublineatus*
Markings in parallel rows, 8 in 10 μ.	11 *C anguste-linearis*
Markings of two kinds. Within the semi-radius in curved, straight or decussating rows, without the semi-radius in radial rows.	12 *C. polychordus*
Markings large angular cells in irregular rows.	13 *C aphrastos*
Markings angular cells, irregular in centre, somewhat concentric near the border	14 *C. concavus*
Markings hexagonal cells, 3 in 10 μ, in a rosette at the centre, slightly decreasing in oblique rows to the broad border.	15 *C. blandus*
Markings in parallel rows becoming granular in a marginal zone A large apiculus near the border	16 *C leptopus*

6. **Coscinodiscus excentricus** Ehrenb., Abh. Akad Berlin 146 1839

Central space absent. Surface flat Markings polygonal with central dots, 4–5 in 10 μ at the centre, decreasing to 8 in 10 μ at the border. Near the centre a single cell is surrounded by several others from which radiate rows of cells to the border, the oblique decussating rows concave to the border. Border narrow, striated, the striae 10 in 10 μ. Apiculi frequently present, numerous, inserted within the border Diam. of v 30–85 μ.

Type locality: Miocene deposits.

Distribution. Marine. Atlantic and Pacific Coasts

Illustrations A Schmidt, Atlas, pl 58, f. 46–49, Van Heurck, Syn. Diat. Belg., pl. 130, f. 4, 8, Boyer, Diat. Phila., pl. 2, f. 14.

Coscinodiscus excentricus sebuensis (Grun) Rattray, Proc. Roy. Soc. Edin. 16: 16 1890. Markings as in type with a prominent nodule near the centre Border distinct Apiculi numerous. Diam usually about 30 μ. Campeche Bay West Indies Caribbean Sea.

7 **Coscinodiscus pustulatus** Mann, Contr U S Nat Herb 10: 257 1907

Valves convex Central space absent Markings hexagonal, about 4 in 10 μ at the centre and decreasing in oblique decussating rows to the border within which is a row of larger markings Border broad, hyaline Diam of v about 100 μ (ex icone)

Type locality. Bering Sea (Mann).

Distribution Marine Known only from the type locality

Illustrations Contr. U. S. Nat Herb 10 pl. 48, f 3

8 **Coscinodiscus minor** Ehrenb Abh Akad Berlin 129 1838

Central space absent Markings polygonal, 5–6 in 10 μ at the centre, radiating to the border where they are 10 in 10 μ the oblique rows slightly curved or irregular. Border narrow, indistinct Apuculi minute, indistinct, at intervals of 5–6 μ Diam of v 23 μ Distinguished from *C excentricus* by the minuteness of the markings at the border and by the slight concavity of the decussating rows This form is not *C minor* W Smith

Type locality Europe

Distribution Marine Atlantic Coast Not common

Illustrations A. Schmidt, Atlas, pl 58, f 39, 40

9 **Coscinodiscus lineatus** Ehrenb Abh Akad Berlin, 129 1838

Surface flat Central space absent Markings hexagonal, 3–4 in 10 μ, with central dots, in straight or nearly straight, parallel rows Border distinct, narrow, with concentric rows of granules, 8 in 10 μ Apiculi minute, frequently absent. Diam of v. 50–100 μ

Type locality Miocene deposits.

Distribution. Marine Campeche Bay. Florida Vera Cruz. Pacific Coast

Illustrations· Ehrenb., Mikrogeol., pl. 18, f. 33; Van Heurck, Syn Diat Belg, pl. 131, f. 3, A. Schmidt, Atlas, pl 59, f. 27–30; Boyer, Diat Phila., pl 3, f 8

10. **Coscinodiscus sublineatus** Grun., Denks. Akad Wien. 48 85 1884.

Surface flat. Central space absent. Markings hexagonal, with evident central dots, a few in radial but mostly oblique decussating rows, sometimes slightly bent, 5 in 10 μ at the centre, 8 or 9 near the border, and suddenly decreasing in a marginal zone to about 15 at the border. Border narrow, hyaline Diam. of v. 52 μ.

Type locality Franz Josef Land.

Distribution· Marine Behring Sea.

Illustrations Grun, Denks Akad Wien. 48. pl. 4, f. 21, 22.

11 **Coscinodiscus anguste-linearis** A Schmidt, Atlas, pl 59 1878

Surface flat to near the border Central space absent Markings hexagonal, 8 in 10 µ, in parallel rows Border very narrow Apiculi small, numerous Diam of v. 45 µ

Type locality Japan

Distribution Marine Atlantic and Pacific Coasts

Illustrations A. Schmidt, Atlas, pl 59, f 34

12 **Coscinodiscus polychordus** Gran Norske Nord -Exp Bot Diat, 30 1897

Valves with a circlet of from 4–9 "arcuate projections" about half the radius from the centre Markings outside of the circlet in radial rows about 10 in 10 µ and in decussating, curved or straight, short rows within Central space absent Border narrow A row of strong spines near the margin Diam of v 24–76 µ. The markings, as remarked by Peragallo, are arranged somewhat like those of *C excentricus*. The frustules are connected by threads which extend from the projections on the circlet and, in this respect, resemble *Thalassiosira*

Type locality Norway.

Distribution Marine North Pacific

Illustrations Gran, Norske Nord -Exp Bot Diat pl 2, f 33, pl 4, f 56

13 **Coscinodiscus aphrastos** Rattray Proc Roy Soc Edin 16 21 1890

Surface slightly convex Central space absent. Markings angular cells, 1½ in 10 µ, a few smaller, intermediate, in irregular rows, minutely and indistinctly punctate Border broad, coarsely defined, with striae 1½ in 10 µ, with intermediate fine striae Diam of v 75–126 µ Near *C concavus* Greg from which it differs chiefly in size of markings

Type locality Campeche Bay.

Distribution Marine Known only from the type locality

Illustrations A. Schmidt, Atlas, pl 65, f. 18

14 **Coscinodiscus concavus** Greg, Trans Roy Soc Edin 31 500 1857
Endictya oceanica Ehrenb, Ber Berl Ak 76 1845

Surface nearly flat Central space absent Markings angular, cells 3½ in 10 µ, nearly equal to the border, irregular in the centre but somewhat concentric near the border. Border opaque, rugose, with coarse striae about 3 in 10 µ In zone view the markings are 4–5 in 10 µ, in rows nearly parallel to the suture. Diam. quite variable to 237 µ.

Type locality Scotland

Distribution. Marine. Atlantic Coast, southward, and Pacific Coast.

Illustrations. Greg, Trans Roy Soc. Edin. 21. pl 10, f 47, A Schmidt, Atlas, pl. 65, f. 10, 12, 13, 15

Endictya campechiana Grun (*Stephanopyxis campechiana* Grun., De-Toni, Syll Alg 2. 1190), differs, according to De-Toni, only in the small obtuse processes on the margin of the valve. After an examination of such material from Campeche Bay it is difficult to distinguish between *C aphrastos*, *C concavus* and *Endictya campechiana* which differs from *C concavus* only in the processes and from *C aphrastos* in size of markings. The secondary markings, as in *Biddulphia favus*, are fainter in some specimens than in others while two or three apiculi have been noticed in *C. aphrastos* The shape of the frustules is box-like

15 **Coscinodiscus blandus** A Schmidt, Atlas pl 59 1878

Surface flat to near border Central space small, surrounded by a rosette of hexagonal cells, a few or each of which contain a distinct granule Markings hexagonal cells, 3 in 10 µ, subequal but smaller at the border, in rows radiating from the rosette, the oblique rows usually slightly concave toward the margin. Cells punctate Border wide, with distinct striae, 6–7 in 10 µ. Apiculi numerous, minute, close to the border Diam of v. 60–70 µ.

Type locality Gulf of Mexico.

Distribution Marine Known only from the type locality

Illustrations A. Schmidt, Atlas, pl 59, f. 36, 37

16. **Coscinodiscus leptopus** Grun, Van Heurck Syn Diat. Belg, pl 131 1881
Coscinodiscus lineatus A Schmidt, Atlas, pl 59, f, 26

Surface flat Central space absent. Markings hexagonal, 3½–4 in 10 µ, with central dots, each cell containing minute granules. At the border the markings become suddenly granulate, forming an irregular, marginal zone Border well defined, narrow, striated, the striae 10 in 10 µ. Apiculi at irregular intervals close to the border, a larger one occurring at a distance within the border. Diam. of v. 100–140 µ.

Type locality: California guano.

Distribution: Marine. Pacific Coast.

Illustrations. Van Heurck, Syn. Diat. Belg., pl. 131, f. 5, 6.

SUBTILES

Markings rounded, in fasciculate rows, 16 in 10 µ. Central space irregular, with two evident nodules.	17. *C. bioculatus*
Markings minute, in radial, fasciculate rows. Central space with small punctum. Apiculi numerous.	18. *C. hyalinus*

Markings irregular at centre, 10 in 10 μ, decreasing to border in fasciculate rows parallel to those at the centre Central space absent.	19	*C. kutzingii*
Markings polygonal, 6 in 10 μ in fasciculate, curved rows. Central space minute or absent.	20.	*C curvatulus*
Markings granular, 6 in 10 μ at centre, larger at semiradius, radiating in fasciculate rows parallel to those at the middle A spine occurs distant from the border	21	*C lentiginosus*
Markings angular, 10 in 10 μ, fasciculate in rows parallel to those in the middle, bent near the border. Spines numerous, with one larger distant from the border	22.	*C. kryophilus*
Markings angular, 8 in 10 μ, in fasciculate rows parallel to those in the middle Hyaline spaces at the centre in the form of a star	23	*C symbolophorus*
Markings minute, 20 in 10 μ, in numerous fasciculi In the centre several, usually five, areolate stellate markings	24	*C. stellaris*
Markings irregular in centre, 10 in 10 μ, forming from 12–18 fasciculi, each of which contains 8–12 rows	25	*C subtilis*
Markings angular, irregular at centre, 10–12 in 10 μ, fasciculate, with rows parallel to the middle rows. Apiculi at border in two rows.	26	*C polyacanthus*
Markings minute, scattered or somewhat fasciculate.	27	*C marginulatus*
Markings polygonal, 6 in 10 μ at centre, fasciculate, the interfasciculate rows parallel to the central	28.	*C rothii*
Markings angular, 5–6 in 10 μ at centre, fasciculate, each fasciculus with 12 rows parallel to the central ones.	29	*C. denarius*
Markings punctate, fasciculate, with 6 rows in each fasciculus	30.	*C. normanii*

17 **Coscinodiscus bioculatus** Grun., Denks. Akad Wien. 48 107 1884

Surface convex. Central space irregular, with two evident nodules. Markings rounded, in fasciculate rows, about 16 in 10 μ at the centre, smaller at the border. Apiculi about 3 in 10 μ, close to the border which is somewhat indefinite. Diam. of v 23 μ

Type locality: Franz Josef Land (under surface of ice floes).

Distribution· Marine. Arctic Sea East coast of Greenland.

Illustrations: Gun., Denks. Akad. Wien. 48 pl. 3, f 30, pl. 4, f. 1.

Coscinodiscus bioculatus exiguus Grun., Denks Akad Wien 48: 108 pl 4 (D), f 2 1884 Central space minute, with either a single granule or with two, one more conspicuous than the other. Markings in radial rows, 24 in 10 µ Apiculi minute, marginal, 4 in 10 µ Diam of v 12–15 µ Cape Eglinton, Baffins Bay (Cleve)

18 **Coscinodiscus hyalinus** Grun Sv Vet Akad Handl II 17^2 113 1880

Central space minute, with a small punctum Markings minute puncta in radial fasciculate rows, 24 in 10 µ Apiculi numerous, in a single circle Border broad, hyaline Diam of v 25 µ

Type locality Sea of Kara

Distribution Marine Disco Island, Greenland (Cleve).

Illustrations: Grun , Sv Vet -Akad Handl II 17 pl 7, f. 128; Denks Akad Wien 48 pl 3 (C), f 28

19 **Coscinodiscus kutzingii** A. Schmidt Atlas, pl 57 1876

Surface flat Central space absent Markings irregular at centre. angular, about 6 in 10 µ, slightly decreasing to the border in fasciculate rows parallel to those at the centre Border wide, striated, the striae in oblique rows, punctate. Diam of v 42 µ

Type locality Cuxhaven.

Distribution Marine Arctic Sea

Illustrations A Schmidt, Atlas, pl 57, f 17, 18

Coscinodiscus Kützingii glacialis Grun , Denks Akad Wien 48 84 pl 4, f 18 1884 Valves with minute apiculi on the border Diam of v 42 µ East coast of Greenland

20 **Coscinodiscus curvatulus** Grun. A Schmidt Atlas pl 57 1876

Surface flat. Central space absent or minute, with a few rounded granules Markings polygonal, 6 in 10 µ, in fasciculate, curved rows, those of each fasciculus parallel to the primary row. Border narrow, striated, the striae about 12 in 10 µ. Diam of v 45–79 µ.

Type locality Miocene deposits of California

Distribution Marine Arctic Sea

Illustrations A Schmidt, Atlas, pl. 57, f 33

Coscinodiscus curvatulus genuinus Grun , Denks Akad Wien 48: 83. pl. 4, f. 13 1884 Central space with one or two granules. Markings 8 in 10 µ Interfasciculate rows prominent. Apiculi scarcely evident, interfasciculate Border with striae 16 in 10 µ Arctic Sea and North Pacific Ocean A. Schmidt, Atlas, pl. 57, f 36. Occasional in H L Smith T S 93

Coscinodiscus curvatulus karianus Cleve & Grun., Sv. Vet -Akad. Handl (2) 17^2 113 pl 7, f. 129 1880 Central space absent. Markings fasciculate, with about 12 rows in each fasciculus, 11–

14 in 10 μ Apiculi interfasciculate, distinct Diam of v 23–24 μ East coast of Greenland (Cleve)

21 **Coscinodiscus lentiginosus** Janisch, A Schmidt Atlas, pl 58

Surface flat Central space absent Markings granular, 6–7 in 10 μ at the centre, slightly larger on the semi-radius, with central dots, radiating in fasciculate rows to the border where they are 8–9 in 10 μ, the interfasciculate rows parallel or nearly so to those in the middle Numerous hyaline interspaces occur at irregular intervals A process or spine is found 4 or 5 μ distant from the margin Border narrow, with striae 16 in 10 μ Diam of v 56–75 μ

Type locality Table Bay

Distribution Marine. Vancouver Island

Illustrations A Schmidt, Atlas, pl 58, f 11.

22 **Coscinodiscus kryophilus** Grun Denks. Akad Wien 48 81 1884

Surface flat to near the border Central space small, irregular Markings angular, 10–12 in 10 μ, smaller at the border, fasciculate, the rows parallel to the middle rows, sometimes bent near the border Numerous short spines within the border and a longer one, sometimes 2 μ in length, inserted at a distance from the border Border indistinct Diam of v 44–54 μ

Type locality Coast of Siberia

Distribution Marine Behring Sea

Illustrations Grun , Denks Akad Wien 48 pl 3, f 21

Thalassiosira clevei Gran (Norwegian North Atlantic Expedition, 7 1897, under Protophyta, 29), is stated by Gran to be nearly allied to *Coscinodiscus kryophilus* Grun and "may possibly be identical with it " Gran also remarks that "a very large number of species of this genus have been described from the structure of the valves When these species become better known in a living state, opinion concerning their systematic conditions will certainly be greatly changed, and the genus divided by biological characters into several new genera "

23 **Coscinodiscus symbolophorus** Grun., Denks Akad Wien 48 82 1884

Surface convex Central space absent or minute At the centre are several hyaline spaces arranged in the form of a star Markings angular, about 8 in 10 μ, at the centre, decreasing to 12 in 10 μ at the border, in fasciculate rows parallel to those in the middle Border narrow, with striae about 20 in 10 μ Diam of v 85–175 μ Resembles *C subtilis* except at the centre.

Type locality Franz Josef Land.

Distribution· Marine. Arctic Sea. Fossil in Sendai, Oamaru, Nottingham and Mors deposits.

Illustrations Grun, Denks. Akad. Wien 48. pl 4, f. 3–6.

24 **Coscinodiscus stellaris** Roper, Quart. Jour Micr Sci 6: 21 1858

Surface convex Central space absent. At the centre are several, usually 5, linear or angular areolate, markings arranged in the form of a star Markings angular, minute, about 20 in 10 μ, scarcely visible, except at the centre, radiating in numerous fasciculi with short oblique rows evident The valves are brown when dry Diam of v. 95 μ.

Type locality England.

Distribution Marine. Arctic and North Atlantic and Pacific Oceans

Illustrations Roper, Quart Jour. Micr Sci 6 pl. 3, f 3

This species is sometimes mistaken for *C. symbolophorus* Grun from which it is clearly distinguished by the fineness of the markings The figure of Ehrenberg, Mikrogeol, pl. 35, 21, f 16, cannot represent this form.

25 **Coscinodiscus subtilis** Ehrenb, Abh. Akad Berlin 412 1841

Surface slightly convex Central space absent Markings irregular in the centre and forming usually from 12–18 fasciculi each of which contains 8–12 rows of angular markings 10 in 10 μ, slightly decreasing to the border Minute interfasciculate apiculi occasionally present Diam. of v 25–112 μ, usually about 70 μ. The number of rows in each fasciculus is more often 12, but variable in the same valve Border narrow, with striae 12 in 10 μ, indistinct.

Type locality Miocene deposits

Distribution Universally distributed, especially in the mud of aestuaries and occasionally in almost fresh water, or water subject to brackish influence

Illustrations A. Schmidt, Atlas, pl. 57, f. 11, 13, Boyer, Diat. Philadelphia, pl. 2, f. 15, 17; H L Smith, T S. 100.

26 **Coscinodiscus polyacanthus** Grun, Cleve & Grun. Sv Vet.-Akad Handl (2) 17^2: 112 1880.

Surface flat Central space absent. Markings angular, irregular in the centre, 15–16 in 10 μ, fasciculate, with rows parallel to the middle rows Apiculi prominent, numerous, near the border. Border narrow, hyaline. Diam. of v. 20–35 μ.

Type locality Sea of Kara.

Distribution: Marine. Arctic Sea.

Illustrations Grun, Sv. Vet.-Akad. Handl (2) 17^2. pl. 7, 127.

Coscinodiscus polyacanthus davisianus Grun, Denks Akad. Wien 48 81 pl 3, f. 19 Markings larger than in type, 10 in 10 µ Apiculi in two indefinite rows Diam of v 35 µ. Davis Strait

Coscinodiscus polyacanthus intermedius Grun., Denks Akad Wien 48· 81 pl 3 (C), f 25. 1884. Markings fasciculate, the secondary rows evident Apiculi less numerous than in type and distant from the border, between and in the middle of the fasciculi Diam of v 60 µ East coast of Greenland

27 **Coscinodiscus marginulatus campechianus** Grun, Van Heurck Syn Diat Belg pl 94 1881

Surface flat Central space absent. Markings minute puncta, scattered, about 8 in 10 µ Border sharply defined, striated, the striae about 12 in 10 µ. Apiculu about 30, one-fifth the radius in length, at irregular intervals. Diam. of v. 44–49 µ

Type locality Campeche Bay.

Distribution Known only from the type locality

Illustrations Van Heurck, Syn Diat. Belg, pl. 94, f 33

Coscinodiscus marginulatus curvato-striatus Grun, Van Heurck, Syn. Diat. Belg. pl. 94, f. 32 Markings in curved fasciculi Apiculi minute. Border striae 8 in 10 µ A. Schmidt, Atlas, pl 57, f. 5. Campeche Bay

Coscinodiscus marginalutus sparsus Grun Van Heurck, Syn. Diat Belg, pl 94, f 31 Markings as in *C marginulatus campechianus* but without apiculi Campeche Bay.

Coscinodiscus marginulatus stelluliferus Grun, Van Heurck, Syn Diat Belg, pl 94, f 34 Valves smaller than the other forms, with the fasciculi marked at the centre by radiating lines Campeche Bay

28 **Coscinodiscus rothii** Grun., Denks. Akad Wien 48 81 1884.

Surface slightly undulate. Central space absent Markings polygonal, 6 in 10 µ at the centre, decreasing to 9–10 in 10µ at the border, fasciculate, the interfasciculate rows parallel to the central ones, with small, hyaline interspaces at intervals between the fasciculi Short apiculi at the middle of the outer margin of each fasciculus. Border striated, the striae 14 in 10 µ. Diam of v. 70–175 µ.

Type locality· Europe.

Distribution. Marine. Georgia rice fields. West Indies

Illustrations: Grun., Denks. Akad Wien. 48 pl 3, f 20, 22.

29. **Coscinodiscus denarius** A. Schmidt, Atlas, pl 57 1878

Surface flat. Central space absent. Markings angular, with central dots, 5–6 in 10 µ, in fasciculate rows, 12 rows in each fasciculus parallel to the central rows Border striated, the striae 12 in 10 μ Differs from *C subtilis* in the larger markings and more definite fasciculi.

Type locality Barbados

Distribution Marine Campeche Bay

Illustrations A Schmidt, Atlas, pl 57, f. 19–22, Boyer, Diat. Phila, pl. 2, f 13

30 **Coscinodiscus normanii** Greg, Quart. Jour Micr Sci 7 80 1859

Coscinodiscus fasciculatus A Schmidt, Jahresb Komm Untersuch deutsch Meere Kiel, 2 95 1874

Coscinodiscus Normanicus Van Heurck, Syn Diat Belg *pl 131* 1881

Valves with slightly convex surface Central space absent. Markings punctate, the puncta 8 in 10 μ at the centre, decreasing toward the border in fasciculate rows, 6 in each fasciculus Apiculi sometimes present Border with delicate, punctate striae Diam. of v 62–112 μ (Rattray)

Type locality England.

Distribution Marine Aleutian Islands (Mann)

Illustrations Quart Jour Micr Sci 7 pl 6, f 3, A Schmidt, Atlas, pl 57, f 9, 10

RADIATI (Grun)

Central space absent Markings polygonal, 3 in 10 μ, nearly equal, at the border 5–6 in 10 μ, in somewhat radiating rows Border narrow	31 *C radiatus*
Central space absent Markings polygonal, irregular, 1½–2 in 10 μ at the centre, slightly decreasing to the wide border.	32 *C marginatus*
Central space absent Markings polygonal, 2 in 10 μ, irregular, decreasing and more granular toward the border, with hyaline interspaces Border wide, robust	33 *C robustus*
Central space absent Markings hexagonal, 3 in 10 μ, smaller at the border, in oblique decussating rows A nodule at the centre.	34 *C nodulifer*
Central space absent 3–8 large cells at the centre. Markings 7 in 10 μ, decreasing to 12 at the border, in irregular, fasciculate rows. Two apiculi near the border	35 *C concinnus*
Central space small or absent A rosette of angular cells at the centre Markings unequal, 3–5 in 10 μ, in subfasciculate rows Two apiculi near the border	36 *C centralis*
Central space rounded Markings punctate, becoming hexagonal toward the border	37 *C nobilis*

Central space large, irregular Markings indistinct at the centre, increasing to border in radial rows	38. *C janischii*
Central space absent or small A rosette of large cells at the centre Markings hexagonal, punctate, unequal, slightly increasing to near the border, then decreasing	39 *C asteromphalus*
Central space absent A rosette of angular cells at the centre Markings hexagonal, 3 in 10 µ, increasing to the border	40 *C borealis*
Central space absent or minute A rosette of large, angular cells at the centre Markings hexagonal, 3 in 10 µ, non-punctate, increasing toward the border, then decreasing	41 *C oculus-iridis*
Central space small, angular Markings larger at the centre, irregular, decreasing, then increasing, smaller at the border	42 *C crassus*
Central space rounded, hyaline Markings polygonal at the centre, slightly increasing and becoming granular, and decreasing to the border	43 *C apiculatus*
Central space irregular, hyaline Markings usually rounded, 3 in 10 µ at the centre, smaller and granular near the border, with small granules at ends of short rows	44 *C perforatus*
Central space hyaline or granular Markings subangular, 4–5 in 10 µ, radiating, with intermediate shorter rows At the border a zone of small granules	45 *C elegans*
Central space absent Surface sometimes with central plication Markings polygonal, 10 in 10 µ, irregular or in oblique rows to semi-radius, thence radiating	46. *C. lacustris*
Central space rounded, hyaline Markings small granules at irregular intervals in radiating rows	47 *C. exiguus*
Central space absent. Markings elongate, 6 in 10 µ	48 *C undulosus*
Central space absent. Markings minute puncta in close, radiating lines, 20 in 10 µ.	49. *C. pellucidus*
Central space large, usually excentric. Markings granular, in longer and shorter rows.	50. *C rotula*
Central space large, granular. Markings granular near centre in widely separated, radial rows.	51. *C. stelliger*
Central space absent. Centre funnel-shaped.	52. *C. bathyomphalus*

31 **Coscinodiscus radiatus** Ehrenb., Abh Akad Berlin 148 1839.

Surface slightly convex. Central space absent. Markings polygonal, with papillae, about 3 in 10 µ, nearly equal to the border where they are 5–6 in 10 µ, in radiating, uneven rows, becoming fasciculate near the border Border narrow, the striae about 7 in 10 µ Diam of v. 60–180 µ.

Type locality Europe

Distribution Marine. Common

Illustrations A Schmidt, Atlas, pl. 60, f 5, 6, 9, Boyer, Diat Phila , pl 3, f 11

Coscinodiscus radiatus medius Grun , Denks. Akad. Wien 48 72 1884 Markings 3½–4 in 10 µ, otherwise as in type. Atlantic and Pacific coasts A Schmidt, Atlas, pl 60, f 10; H L Smith, T S 98

Coscinodiscus radiatus minor A Schmidt, Jahresb. Komm Untersch deutsch Meere Kiel, 94 1874 pl. 3, f. 34. Markings 4 in 10 µ at the centre, 8 in 10 µ at the border. Diam. of v 30–50 µ Van Heurck, Syn. Diat Belg , pl 130, f. 3 Campeche Bay

The variations of *C radiatus* are quite numerous. In very large specimens a minute central space sometimes occurs. The markings are rarely 2 in 10 µ

32 **Coscinodiscus marginatus** Ehrenb , Abh. Akad Berlin, 142 1841

Surface slightly convex. Central space absent Markings polygonal, with large papillae, 1½–2 in 10 µ at the centre, decreasing to 3 in 10 µ at the border, without order at centre and radiating to the border. Border wide, coarsely striated, the striae 4 in 10 µ Diam of v. 90 µ

Type locality. Miocene deposits of the Atlantic and Pacific States

Distribution Marine Pacific Coast. Postmiocene of the Atlantic States

Illustrations A Schmidt, Atlas, pl. 62, f. 1–5, Boyer, Diat Philadelphia, pl. 3, f 9, H L. Smith, T. S. 94, 95.

33 **Coscinodiscus robustus** Grev , Trans. Micr Soc. Lond 14 3 1866

Coscinodiscus subvelatus A. Schmidt, Atlas, pl. 65, f 9 1881

Surface convex. Central space absent. Markings more or less angular at centre, with prominent papillae, 2 in 10 µ, in irregular rows, decreasing and gradually becoming more and more granular toward the border, with hyaline interspaces Short, oblique rows evident on the semi-radius. Border broad, robust, with coarse, irregular striae, 4–5 in 10 µ. Diam of v 82–325 µ.

In the girdle band of this and other species, such as *C. crassus* Brun, the zone of each valve is open on one side and into this opening fits a T-shaped process of the other zone, the two openings not, however, opposite each other

Type locality Monterey Miocene deposit

Distribution Marine. Pacific Coast

Illustrations Grev, Trans. Micr Soc. Lond, 14 pl 1, f. 8,

C. robustus and *C marginatus* are sometimes confounded In the former the markings gradually become more granular toward the border, while in the latter the hyaline interspaces are not evident. The former is usually larger and is not common while the latter is abundant Certain forms, however, appear to be intermediate

34 **Coscinodiscus nodulifer** A. Schmidt Atlas, pl. 59 1878

Surface flat Central space absent Markings hexagonal, with faint papillae, 3 in 10 µ, with somewhat larger cells at intervals, smaller at the border, in oblique, decussating, irregular rows A nodule occurs at or near the centre Border narrow, with striae 6 in 10 µ. Diam of v 65–126 µ

Type locality California coast

Distribution Marine Pacific Coast

Illustrations A Schmidt, Atlas, pl 59, f. 21–23.

Coscinodiscus nodulifer apiculatus Rattray, Proc Roy Soc Edin. 16 72 1890 Markings 4 in 10 µ, decreasing to 6 in 10 µ at the border. Apiculi at the border indistinct Campeche Bay A. Schmidt, Atlas, pl 59, f 20

35 **Coscinodiscus concinnus** W Smith Syn Brit Diat 2 85 1856

Surface convex Central space absent At the centre from 3–8 large, angular, punctate cells Markings polygonal, 7–8 in 10 µ, decreasing to 12 at the border, in fasciculate, irregular, radial rows. Minute apiculi at the border and near it two large apiculi Diam. of v to 350 µ According to L W Bailey the large central cells are found in only one valve of the frustule.

Type locality England

Distribution Marine. Vancouver, B C (L W. Bailey)

Illustrations Roper, Quart Jour Micr Sci., 6 pl 3, f 12 (1858); A Schmidt, Atlas, pl. 114, f 8, 9.

Coscinodiscus concinnus jonesianus (Grev) Rattray, Proc Roy. Soc. Edin. 16: 84 1890. *Eupodiscus jonesianus* Grev, Trans. Micr. Soc Lond., 10: 22. pl 2, f. 3. 1862 Markings fasciculate, about 6 at the centre and decreasing to 12 at the border. Two large, conical processes within the border Border very narrow, striated. Diam. of v. to 400 µ. Differs from the type in its coarser markings Greenland and probably southward Somesville, Me. (as *Eupodiscus commutatus* Grun) (A P Aubert) H L Smith, T S 92

For a study of the protoplasm and nucleus of *C concinnus* see Le Diatomiste, 2 114 pl 8, in an article by Dr Miquel

36 **Coscinodiscus centralis** Ehrenb Mikrogeol pl 21 em Rattray Proc. Roy Soc Edin 16 107 1890

Surface convex. Central space small or absent At the centre a rosette of angular cells, 2½–3 in 10µ Markings hexagonal, finely punctate, unequal, 3–5 in 10 µ, in nearly straight, subfasciculate rows Minute apiculi sometimes present at the border and two large apiculi within it. Border narrow, the striae 6 in 10 µ Diam. of v to 155 µ -The species is similar to *C concinnus* from which it differs in the coarseness of the markings

Type locality Oran deposit Algeria

Distribution Marine. Behring Sea Gulf of California Davis Strait, Florida

Illustrations A. Schmidt, Atlas, pl 63, f 1, Mikrogeol, pl 18, f 39, pl. 21, f 3, H L Smith, T S 92 See also Schultze, in Quart. Jour Micr Sci 7 13 pl 2, f 13 1859

37 **Coscinodiscus nobilis** Grun, Jour Roy Micr Soc. 2 687 1879

Valves slightly convex, with hyaline central space. Markings punctate, the puncta 7 in 10 µ, becoming larger and hexagonal toward the border, radiating in subfasciculate lines Diam. of v. to 540 µ

Type locality England

Distribution: Marine Pacific Coast (Mann)

Illustrations Jour. Roy Micr Soc. 2 pl 21, f 1

38. **Coscinodiscus janischii** A Schmidt Atlas pl 64. 1878

Surface flat Central space large, irregular Markings indistinct from the centre to near the border, 4 in 10 µ at the centre, increasing slightly to the border, where they are hexagonal and well defined. Rows of markings nearly straight, radial Border narrow, the striae 5 in 10 µ. Diam of v to 245 µ

Type locality· Peruvian guano

Distribution Marine. Gulf of California.

Illustrations A. Schmidt, Atlas, pl. 64, f 3, in H. L. Smith, T. S. 91. Near *C. gigas* Ehrenb., which occurs in the miocene deposits.

39 **Coscinodiscus asteromphalus** Ehrenb., Abh. Akad. Berlin, 77 1844.

Surface slightly convex at the semi-radius or near the border. Central space absent or minute, surrounded by a rosette of large, angular, elongated cells. Markings hexagonal, punctate, with distinct papillae, somewhat unequal, 3–3½ in 10 μ to the semi-radius, increasing slightly in radiating rows to 2½–3 in 10 μ near the border where they sometimes slightly decrease Border narrow, with granular striae 4–5 in 10 μ Diam of v 85–300 μ. This species resembles C *oculus-iridis* which, however, is not punctate

Type locality Miocene deposits.

Distribution Marine Gulf of California Atlantic Coast

Illustrations Mikrogeol, pl 18, f 45, Van Heurck, Syn Diat. Belg, pl 130, f 1, 2, 5, 6, Boyer, Diat Phila, pl 2, f 16, pl 40, f 12.

Coscinodiscus asteromphalus hybridus Grun, Denks Akad. Wien 48 79 pl 3, f 9 Markings 4 in 10 μ near the rosette, increasing to 3½ at the semi-radius and decreasing to 5–6 in 10 μ at the border Davis Strait Barden Bay, Greenland A Schmidt, Atlas, pl 113, f 1, 22

40. **Coscinodiscus borealis** Bailey Amer Jour Sci 22 3 1856

Surface convex near the border Central space absent. At the centre a rosette of large, angular cells from which radiate hexagonal cells with papillae, about 3 in 1 μ, increasing to near the border to 2 in 10 μ Border narrow, with coarse striae, 4 in 10 μ Diam of v 150–250 μ.

"Distinguished from C *Oculus-Iridis* by the coarser and more robust markings" (Rattray)

Type locality: Sea of Kamtschatka

Distribution Marine Behring Sea

Illustrations A Schmidt, Atlas, pl 63, f 11, H L Smith, T S. 90, 93, 95.

41 **Coscinodiscus oculus-iridis** Ehrenb Abh Akad Berlin 147 1839

Surface flat. Central space absent or minute A central rosette of large, angular cells from which radiate rows of hexagonal cells with papillae, non-punctate, 3–3½ in 10 μ, increasing to near the border to 2½ and decreasing at the border to 5 in 10 μ Border narrow, with striae 6–7 in 10 μ Diam of v to 300 μ

Distinguished from C. *asteromphalus* which it closely resembles by its non-punctate cells

Type locality Miocene deposits

Distribution: Marine Common.

Illustrations: Mikrogeol., pl. 18, f. 42; A. Schmidt, Atlas, pl 63, f. 6, 7, 9; Boyer, Diat. Phila, pl. 3. f 10.

Coscinodiscus oculus-iridis tenui-striatus Grun., Denks. Akad. Wien 48: 77. 1884. Surface convex near the border. Markings

5 in 10 μ at the centre, decreasing to 7 in 10 μ near the border. Diam of v 140–150 μ Campeche Bay

42 **Coscinodiscus crassus** Bailey, Amer Jour Sci 22 4 1856

Central space small, angular Markings larger at the centre, 2½ in 10 μ, angular, somewhat irregular, becoming smaller and then increasing to larger hexagonal cells, smaller at the border. Border striae coarse, 4 in 10 μ Diam 120–140 μ Near *C heteroporus* Ehrenb from which it differs in its larger markings.

Type locality Sea of Kamtschatka.

Distribution Marine North Pacific Coast of Barbadoes

Illustrations A Schmidt, Atlas, pl. 61, f 19, in H L Smith, T. S 90

43 **Coscinodiscus apiculatus** Ehrenb, Abh Akad Berlin, 77 1844.

Surface flat Central space rounded, hyaline Markings polygonal at the centre, 4 in 10 μ, slightly increasing to the semi-radius and then usually becoming granular and decreasing to 6–8 in 10 μ at the border Border narrow, coarsely striated, the striae 6–8 in 10 μ Diam 60–112 μ.

Type locality Miocene deposits

Distribution Marine Port Townsend Bay, Wash

Illustrations· A Schmidt, Atlas, pl 64, f 5

44 **Coscinodiscus perforatus** Ehrenb Abh Akad Berlin 78 1844

Surface flat. Central space irregular, hyaline Markings angular or somewhat rounded, 3–4 in 10 μ at the centre with distinct papillae, usually 3 at the semi-radius and 4 in 10 μ near the border and smaller rounded granules at the border Small granules at the inner ends of short rows Border narrow, striae coarse, 5–6 in 10 μ. Diam 90–132 μ.

Type locality Miocene deposits

Distribution Marine. Pacific Coast

Illustrations A. Schmidt, Atlas, pl 64, f 12–14

The variations in *C apiculatus* and *C. perforatus* are quite numerous both in the Miocene deposits of the eastern and western states and in the living forms. In general it may be stated that *C apiculatus* usually exhibits more granular markings toward the border, in a zone sometimes not quite symmetrical, and the cells at the centre are larger. In *C. perforatus* the centre is surrounded by smaller cells which, in some cases, are separated by hyaline spaces and the shorter rows have a minute punctum or granule at their origin *C apiculatus* as a living form is rare while *C. perforatus* in its type form is, perhaps, not found in the North

Pacific It is quite possible that some specimens from dredgings came from fossil deposits along the coast

45. **Coscinodiscus elegans** Grev, Trans. Micr Soc Lond, 14 3. 1866.

Surface flat Central space hyaline in smaller specimens or with crowded granules in larger Markings rounded or subangular, 4–5 in 10 μ, with distinct dots, radiating, with shorter rows intermediate At the border a zone of small granules is found In small valves hyaline interspaces are more evident than in large valves Border striated, the striae about 18 in 10 μ Diam. 40–80 μ. Small apiculi noticed in some specimens.

Type locality Monterey Miocene deposits.

Distribution Marine Pacific Coast.

Illustrations. Grev, Trans Micr. Soc Lond., 14 pl. 1, f 6, A. Schmidt, Atlas, pl 58, f. 7

46 **Coscinodiscus lacustris** Grun, Sv Vet.-Akad Handl II 17^{2} 114 1880

Surface convex Central space absent. Markings polygonal, 10 in 10 μ at the centre, irregular or in oblique rows for half the radius, thence radiating and at the border 12 in 10 μ Apiculi in a single circlet near the border, about 4 in 10 μ Diam 42 μ The above is a description of a variety without central plication, but it is not quite that of either of the varieties, *septentrionalis* or *marina*, although nearer the former

Type locality Kara Sea

Distribution Marine Hudson Strait

Illustrations Grun, Denks Akad Wien 48 pl 4, f 33 (nearly)

47 **Coscinodiscus exiguus** Rattray Proc Roy Soc Edin 16 130 1890

Surface flat Central space rounded, about one-sixth the radius in diameter, hyaline Markings small granules at irregular intervals in radiating rows Border well defined, narrow, with striae 8 in 10 μ. Diam 40–54 μ Under high magnification an inner layer is noticed.

Type locality Campeche Bay

Distribution: Marine. Known only from the type locality

Illustrations: A. Schmidt, Atlas, pl. 58, f 30

48. **Coscinodiscus undulosus** Mann, Contr U S. Nat. Herb., 10^{4} 259 1907

Valves delicate, with slightly convex surface Central space absent Markings radiating, "elongated in the radial line," about 6 in 10 μ. Border broad, hyaline. Diam. of v. 132 μ. (ex icone).

Type locality Bering Sea (Mann).

Distribution Marine. Known only from the type locality.

Illustrations Contr. U. S. Nat Herb 10 · pl. 49, f. 1.

49 **Coscinodiscus pellucidus** Grun in Van Heurck Syn Diat. Belg pl 132 1881
Odontodiscus pellucidus Grun, in Cleve, Vega-Exp Iaktt 3 488 1883

Surface convex Central space absent Markings minute puncta, almost invisible, in close radiating lines more evident near the margin, 20 in 10 µ Border narrow, hyaline? Diam 38 µ

Type locality Davis Strait

Distribution Marine. Greenland Hudson Strait

Illustrations Van Heurck, Syn Diat Belg, pl 132, f 8

50 **Coscinodiscus rotula** Grun in A Schmidt Atlas pl 57 1878

Surface flat Central space circular, large, usually excentric Markings granular in radial rows, longer and shorter, with wide hyaline interspaces Border distinct, with granules opposite the ends of the rows Diam of v. 27–30 µ (Rattray)

Type locality Campeche Bay

Distribution Marine Known only from the type locality

Illustrations A Schmidt, Atlas, pl 57, f 6, 7

51 **Coscinodiscus stelliger** Grun A Schmidt Atlas, pl 58 1878

Central space circular, large, with a few granules Markings granular, larger near the centre, decreasing at the border, in widely separated, radiate rows, with hyaline interspaces Border distinct, with markings opposite the radial rows Diam of v 35 µ (Rattray) Near *C rotula*

Type locality Campeche Bay

Distribution Marine Known only from the type locality

Illustrations A Schmidt, Atlas, pl 58, f 10

52 **Coscinodiscus bathyomphalus** Cleve Vega-Exp Iaktt 3 489 1883

Central space absent Surface with centre funnel-shaped, round. Markings in straight, radial rows, the puncta smaller toward the border Diam of v 20–30 µ

Type locality Spitzbergen

Distribution Marine East coast of Greenland (Cleve).

Illustration Cleve, Vega-Exp Iaktt 3 pl 38, f 81.

7 STEPHANODISCUS Ehrenb, Ber Akad Berlin 1845: 80 1845

Frustules usually solitary Valves circular, somewhat inflated. Markings radiating rows of granules with hyaline interspaces. Margin of valve usually with a row of spines

Type species, *Stephanodiscus niagarae* Ehrenb ?

Markings irregular at centre, thence radiating, with
shorter rows forming double rows at the border 1. *S. niagarae*
Markings radiating from the centre, with shorter
rows forming fasciculi of four rows at the border 2 *S astraea*

1 **Stephanodiscus niagarae** Ehrenb , Ber Akad Berlin 1845 80 1845

Valves elevated at centre, with a depressed zone between it and the convex margin. Markings irregular at the centre, thence radiating, 16–18 in 10 μ, the shorter rows beginning at about one-third the radius from the centre and forming double rows to the border, with hyaline interspaces Border with closely radiating lines of minute granules Prominent, curved spines opposite alternate interspaces Diam 65 μ

Type locality Niagara

Distribution Fresh water Local. Lake Erie Buffalo Montreal (H C Wheeler)

Illustrations Van Heurck, Syn Diat Belg pl 95, f 13, 14, A Schmidt, Atlas, pl *227*, f 1–3, 7 9

2 **Stephanodiscus astraea** (Ehrenb) Grun Cleve & Grun Sv Vet -Akad Handl (2) 17^2 114 1880

Discoplea astraea Ehrenb , Ber Akad Berlin 1844 267 1844

Central part of valve concave Central space indefinite, with a few granules Markings minute granules, 15 in 10 μ, radiating from the centre, with successive shorter rows forming fasciculi, with prominent, hyaline interspaces Small spines inserted near the border opposite the spaces Diam to 40 μ

Type locality Europe

Distribution Marine, brackish and fresh water Lake Michigan Arctic Sea Atlantic coast

Illustrations Van Heurck, Syn Diat Belg , pl 95, f 5, A Schmidt, Atlas, pl *226*, f 1–5

Stephanodiscus astraea spinulosus Grun , Van Heurck, Syn Diat Belg , pl 95, f 6 Central space circular, with a central granule Markings minute granules, 15 in 10 μ at the centre, decreasing to the border in numerous radiate, somewhat curved lines, with hyaline interspaces Intermediate rows at the border produce the appearance of double rays Small spines occur, usually opposite each second or third row of puncta Diam 55 μ Coast of Barbadoes A. Schmidt, Atlas, pl *226*, f 6–15

Stephanodiscus astraea minutulus (Kütz) Grun , Van Heurck, Syn. Diat. Belg , pl 95, f. 7, 8 *Cyclotella minutula* Kütz , Bac. 50. 1844 Centre of one valve concave, of the other convex Markings 12–15 in 10 μ, radiating from the indefinite centre, the fasciculi at the border each consisting of two rows Spines absent. Diam 20–40 μ Lake Michigan A Schmidt, Atlas, pl *226*, f. *16*, 17

8 **THALASSIOSIRA** Cleve, Bih. Sv Vet Akad Handl 1¹⁸ 6 1873

Frustules slightly siliceous, connected in long chains by prolonged mucous threads extending from the centres of the valves. In zone view rectangular, rounded, truncated or octagonal. Connective zone with minute puncta in rows parallel to the longitudinal axis Valves circular, with almost invisible puncta in radiating curved and decussating lines. A row of short spines on the margin. Chromatophores elliptical or irregular granules or small discs.

Type species, *Thalassiosira nordenskiöldii* Cleve

Frustules with obliquely truncate angles. Spines short.	1. *T. nordenskiöldii*
Frustules with slightly rounded angles. Spines minute.	2 *T gravida*

1 **Thalassiosira nordenskioldii** Cleve Bih. Sv Vet.-Akad Handl 1¹⁸ 7 1873

Valves with markings scarcely visible except when dry when the color is a "pale yellowish brown" The short spines are somewhat distant from each other, clavate. Frustules in zone view rectangular, with obliquely truncated angles. Diam. 12–43 µ.

In the formation of spores the cell contents of the frustule pass to one valve and a new valve is formed within, somewhat as in the case of *Chaetoceros* or as in ordinary reduplication in filamentous forms when half completed (Gran, in part).

"Occurs in enormous large masses, floating on the surface of the sea and coloring it for many miles in extent" (Cleve).

Type locality Davis Strait.

Distribution Marine Arctic Sea. North Atlantic.

Illustrations. Cleve, Bih. Sv. Vet-Akad Handl. 1¹⁸ pl 1, f. 1; Van Heurck, Syn Diat. Belg. pl. 83, f. 9; Gran, Norske Nord Exp. Diat pl. 4, f. 59, H. L. Smith, T. S 593.

2 **Thalassiosira gravida** Cleve, Bih. Sv Vet.-Akad Handl 22 (3)⁴: 12 1896

Frustules in zone view rectangular, with slightly rounded angles, united in long chains by a thick cord from the centre of the valves. Valves circular, with markings minutely punctate, almost invisible. Spines on the border minute. Diam. usually about 35 µ.

Type locality North Atlantic •

Distribution. Pelagic. Arctic Sea and North Atlantic. Davis Strait.

Illustrations: Cleve, Bih. Sv. Vet-Akad Handl. 22 (3)⁴ pl. 2, f. 14–16; Gran, Norske Nord. Exp. Bot. Diat. pl. 4, f. 57, 58.

Coscinodiscus subglobosus Cleve & Grun. (Denks. Akad.-Wien 48: 84. pl. 4 (D), f. 19, 20, 1884; A Schmidt, Atlas, pl. 58, f. 44

has been identified by Cleve (Bih Sv Vet-Akad Handl. 22 (3)⁴. 13) as the endocyst of *Thalassiosira gravida* Cleve.

Podosira glacialis (Grun.) Cleve, Bih Sv. Vet.-Akad. Handl. 22 (3)⁴ 12. pl 2, f 17–20 This form is considered by Cleve as possibly a large form of *Thalassiosira gravida* Plankton of Baffin Bay

9. **SKELETONEMA** Grev Trans. Micr Soc Lond II 13 43 1865

Frustules scarcely siliceous, cylindrical, disc-shaped when young and oblong when fully grown, connected by numerous thread-like processes in filaments of indefinite length Valves circular, plane or slightly convex.

Type species, *Skeletonema barbadense* Grev (fossil).

1 **Skeletonema costatum** (Grev) Cleve Bih Sv Vet-Akad Handl 11 7 1873

Melosira costata Grev, Trans Micr Soc Lond 14 77 1866

Frustules hyaline, united by numerous (15–20) straight, thread-like processes from the margins of the valves, the union of the processes forming an evident line where they coalesce Valves slightly convex. The markings on the fully developed frustules appear, under careful illumination, to be minute puncta in longitudinal rows Diam 6–12 μ. The length of the process varies considerably but is usually about 8 μ and they are always of equal length between opposite frustules The frustules are so delicate as to be frequently constricted after mounting or when dry

Type locality Barbados.

Distribution Pelagic. West Indies. Bay of Fundy. Vancouver.

Illustrations Grev, Trans Micr. Soc. Lond. 14. pl 8, f 3–6, Van Heurck, Syn. Diat Belg, pl. 91, f. 4, 6, A Schmidt, Atlas, pl 180, f 45; L W. Bailey, Contr. Can Biol. (1915), pl 2, f 12; H. L Smith, T S. 219

2. Actinoptycheae

Actinoptychus Valves divided into plane sectors, areolate and punctate.

Polymyxus. Valves divided into convex, punctate sectors.

Arachnoidiscus Valves divided into sectors by radiate costae.

Stictodiscus. Valves divided into sectors by radiate, hyaline lines.

Asterolampra. Valves divided by hyaline rays into marginal, equal, punctate segments.

Asteromphalus. Valves divided by hyaline rays into unequal, cellular segments.

10 **ACTINOPTYCHUS** Ehrenb. Abh Akad Berlin 1839 137 1840

Valves usually circular, divided into sectors alternately elevated and depressed Markings areolate and punctate Central space hyaline Small spinous processes frequently present, one on each or each alternate sector close to the border The areolation is confined to the outer and the punctation to the inner stratum

Type species, *Actinocyclus senarius* Ehrenb.?

Sectors 6.	
Processes 3 (usually)	
Markings areolate and punctate	1. *A undulatus*
Markings punctate, areolations obsolete	2 *A gruendleri*
Markings areolate, unequal in alternate sectors	3 *A ranunculus*
Markings areolate, indistinct. Spines connected with central space by hyaline lines	4 *A trilineatus*
Processes 6	
Markings punctate	5 *A. summissus*
Processes numerous	6 *A trilingulatus*
Sectors 10–22	
Markings angular areolations and puncta in decussating lines	7 *A splendens*
Markings with hyaline areas appearing as dark spots	8. *A maculatus*

1 **Actinoptychus undulatus** (Bailey?) Ralfs Pritchard, Infusoria 839 1861

Actinocyclus sp Bailey, Amer Jour Sci, 42 pl 2, f 11 1842
Actinocyclus undulatus Kütz, Bac, 132 1844

Sectors six, the alternate division not in the same plane as the others, areolate and punctate in quincunx The areolations usually hexagonal. confluent toward the border, in large specimens in parallel lines on alternate sectors. Central space hyaline, hexagonal or circular Processes short, within the inner edge of border, usually three but sometimes six Border narrow, faintly striated. Diam 60–80 μ Chromatophores round and scattered

The variations of the species are numerous, especially in the distinctness of the areolation which is sometimes apparent on alternate sectors only while in others it almost entirely disappears, due partly to the separation of the strata

Type locality Miocene deposits of the Eastern States

Distribution Marine and brackish. Atlantic and Pacific Coasts

Illustrations Kütz, Bac, pl 1, f. 24; W. Smith, Syn Brit Diat, 1. pl. 5, f 43; Pritchard, Infusoria, pl. 8, f. 15, A Schmidt, Atlas, pl. 1, f. 1–4, Boyer, Diat. Philadelphia, pl. 4, f. 1, 2, 4, 6

Specimens occur in Leete's Island, Connecticut, in which the areolations are not hexagonal but bounded by vermicular or labyrinthine lines which toward the border are resolved into straight, parallel lines The possibility of this being an inner plate is contraindicated by the presence of processes

2 **Actinoptychus gruendleri** A Schmidt Atlas pl 1 1875

Sectors six Central space hexagonal Markings punctate in quincunx, the areolations obsolete Alternate sectors with hyaline spaces at the border, sometimes continued around the margin and along the sides, the intermediate sectors well defined, with processes, usually two, on their margin A submarginal zone surrounds the valve, about one-sixth the radius in width, with decussating puncta continued from the sectors, but indistinct Border narrow, well defined, striated Diam 100–130 µ

Type locality California (fossil)

Distribution Marine Coast of Lower California (Mann)

Illustrations A Schmidt, Atlas, pl 1, f 22, pl 100, f 3, 4

3 **Actinoptychus ranunculus** Brun in A Schmidt Atlas pl 155 1880

Sectors six Central space hexagonal Areolations of alternate sectors larger than those of the others Border of sectors without spines, appearing hyaline owing to the bevelling of the edge Diam 65 µ

Type locality Atlantic City, N J (fossil)

Distribution Marine Leete's Island, Conn

Illustrations A. Schmidt, Atlas, pl 155, f 1

4 **Actinoptychus trilineatus** Boyer Contr Biol & Micr Sect Phila Acad 1 1 1923

Sectors six Central space hexagonal Areolations somewhat indistinct Spines on alternate sectors, connected with the central space by a furrow or hyaline ray Diam 56 µ

Type locality Mosquito Inlet, Florida

Distribution Marine Known only from the type locality

Illustrations Contr Biol & Micr Sect Phila Acad 1 pl 1, f 1

Differs from *A trifurcatus* Tempère & Brun in areolation, border and size. It resembles *A hillabyanus* Brun from which it differs chiefly in the central space and in the markings

5 **Actinoptychus summissus** A. Schmidt Atlas pl 1 1875

Sectors six Central space hexagonal, Markings punctate, not areolate. Processes six, minute. Diam 43 µ Possibly one of the numerous forms of an inner plate of *A undulatus*.

Type locality Puerto Cabello

Distribution Marine. Leete's Island, Connecticut.

Illustrations A. Schmidt, Atlas, pl. 1, f 13

Actinoptychus trilingulatus (Brightw) Ralfs, in Pritchard Infusoria, 840 1861

Actinocyclus trilingulatus Brightw , Quart Jour Micr Sci , 8 93 1860
Triceratium trilingulatum (Brightw) A Schmidt, Atlas, pl 1 1875
Schuettia trilingulata (Brightw) De-Toni, Syll Alg 2 1396 1894

Valves convex, subconical, orbicular Sectors six Central space trilingulate Markings fine puncta, about 15 in 10 µ, in oblique, decussating lines Near the border of alternate sectors a row of short spines varying in number from 6–18, according to the size of the valve Diam 50–107 µ

Type locality West Indies (Brightw)

Distribution Known (in N. America) only from the type locality.

Illustrations A Schmidt, Atlas, pl 1, f. 20, Quart Jour Micr Sci 8 pl 5, f. 2

I have not found this form in material from the West Indies. The description is from specimens from the coast of Madagascar where it is not uncommon

7 **Actinoptychus splendens** (Shadb) Ralfs in Pritchard Infusoria 840 1861

Actinophaenia splendens Shadb , Quart Jour Micr Sci 8 94 1860

Sectors 12–22 Central space circular or polygonal, hyaline. Alternate sectors slightly rising toward the margin, with a process near the border A hyaline ray extends from the central space to each process. Markings angular areolations and puncta in decussating lines, obscure near the margin on the intermediate sectors Border narrow, striated Diam quite variable to 200 µ

Type locality Wales

Distribution Marine Atlantic and Pacific Coasts.

Illustrations Quart. Jour. Micr. Sci 8 pl 6, f 18, Van Heurck, Syn Diat Belg., pl. 119, f. 1, 2, 4

Actinoptychus splendens halionyx Grun , Van Heurck, Syn. Diat. Belg , pl 119, f 3, is smaller, with a rounded central space and more prominent areolations. A variety occurs off the California coast with ten sectors and obsolete areolations.

Actinoptychus glabratus incisus Grun , Van Heurck, Syn. Diat Belg , pl 120, f 8, is fossil in the Santa Monica, Cal deposit and is reported by Tempère and Peragallo as occurring in Puget Sound. It is to be considered, probably, as a variation of *A. splendens* (Shadb.) Ralfs

8. **Actinoptychus maculatus** Grove & Sturt , A. Schmidt, Atlas, pl. 132 1888.

Actinoptychus vulgaris maculatus Grove & Sturt, Jour Quek Club, Ser 2, 3^{11} 64 1887

Valves circular, with sixteen sectors. Central space circular. Sectors without spines with a circular hyaline margin. Striae oblique, decussating, with puncta about 12 in 10 μ Inner stratum with rounded, hyaline spaces appearing as spots on the rays Two hyaline markings on each side of each spine Diam 140 μ

Type locality Oamaru, New Zealand (fossil)

Distribution Marine Port Townsend, Wash Rare

Illustrations· Jour Quek Club, Ser 2, 3 pl 5, f 5, A Schmidt, Atlas, pl 132, f 18

Species Reported

The following forms are referred to in Tempère et Peragallo, Diatomées du Monde entier, 1915

Actinoptychus socius A Schmidt var Diat du Monde entier, 100 This variety, undescribed, is reported from Quinnipiac, Conn. A Schmidt, Atlas, pl 1, f 11

Actinoptychus notabilis Pant. This citation, Diat du Monde entier, 154, is referred to in Tables des Espèces as *Actinoptychus notabilis* Brun, an entirely different form, which occurs fossil at Atlantic City, N J, in the artesian-well deposit I have found one specimen in the Leete's Island material exactly corresponding to the fossil form.

Actinoptychus pseudoantistrophus M Perag, Tempère & Peragallo, Diat du Monde entier, 103 This form, reported from Quinnipiac, Conn, is said to differ from *A antistrophus* Brun in having a spine on each compartment

Actinoptychus wollei M. Perag., Tempère & Perag., Diat. du Monde entier, 198 According to Peragallo near *A. biformis* Brun (A Schmidt, Atlas, pl 156, f 6–8), but with a circular marginal area in the sectors without spines Leete's Island, Conn

Actinoptychus racemosus A. Schmidt var Diat. du Monde entier, 103 This variety, undescribed, is reported from the Quinnipiac River, Conn

Actinoptychus planus Mann, Contr U. S. Nat. Herb. 10^5 271 pl. 45, f 2 1907 This form, from description and figure, does not differ in any respect from many specimens occurring with *Actinoptychus undulatus* and which, undoubtedly, are inner valves or plates of that species

11 **POLYMYXUS** L. W Bailey, Bost. Jour Nat. Hist 7 341 1861

Frustules in zone view quadrangular, with subconical elevations terminated by processes. Valves circular, usually divided into fourteen sectors, on the same plane at the centre but alternately elevated at the border into mammilated projections terminated by processes on the margin Sectors not areolated as in *Actinoptychus*

Type species, *Polymyxus coronalis* L W Bailey

1 **Polymyxus coronalis** L W Bailey Bost Jour Nat Hist. 7 341 1861

Central space hyaline, rounded or slightly stellate, from which radiate rows of fine puncta in quincunx, 14 in 10 μ The elevated sectors number from six to ten Processes small, cylindrical, close to the border Diam of v 85 μ

Type locality Mouth of Para River, Brazil

Distribution Marine and brackish Delaware River mud

Illustrations Bost Jour Nat Hist 7 pl. 8, f. 55–59; Van Heurck, Syn Diat Belg pl 123, f 4, A Schmidt, Atlas, pl 132, f 2–4, Boyer, Diat Phila pl 4, f 7

12 **ARACHNOIDISCUS** Ehrenb Ber Akad Berlin 1849 64 1849

Frustules solitary, disc-shaped, sessile on algae Valves circular, plane, divided into sectors by costae radiating from a circular, usually hyaline centre, with shorter intermediate costae near the circumference Surface covered with concentric lines of coarse granules

Type species, *Arachnoidiscus ornatus* Ehrenb.

Costae alternating with shorter rays	1	*A. ehrenbergii*
Costae connected by transverse rays	2	*A. ornatus*
Costae short, marginal Rays hyaline	3	*A. indicus*

1 **Arachnoidiscus ehrenbergii** Harv & Bail U S. Expl Exp 17: 174. 1862

Central space circular, hyaline, or occasionally granular, surrounded by a double circle of large granules or by a circle of granules and short, radiating costae From the central space extend numerous rays or costae which near the circumference alternate with one or two shorter rays Between the costae the surface is marked in concentric circles with coarse, rounded or quadrate granules with a central dot. The costae and the granular markings are separable into two layers. Margin coarsely striated Diam. of v. 100–300 μ.

Type locality Japan

Distribution. Marine Pacific Coast.

Illustrations· U S Expl. Exp 17 Algae pl. 9, f. 9, W. Smith, Syn. Brit. Diat. 1 pl 31, f 256; A. Schmidt, Atlas, pl. 68, f. 1.

Arachnoidiscus ehrenbergii californicus A. Schmidt, Atlas, pl. 68, f. 3, 4, pl. 73, f 1. A smaller form approaching *A ornatus* Ehrenb.

Arachnoidiscus ehrenbergii cuneatus Monks, Proc Acad. Phila. 72 207. 1920. Valves ovate-cuneiform, variable in size, with the markings of *A. ehrenbergii.* San Pedro Bay, Cal. Abundant.

2 **Arachnoidiscus ornatus** Ehrenb Ber Akad Berlin 64 1849

Valves as in *A ehrenbergii* but with transverse costae between the rays, becoming oblique toward the circumference

Type locality South Pacific

Distribution Marine Coast of California.

Illustrations Ralfs, in Pritchard, Infusoria, pl 15, f 18–21, A. Schmidt, Atlas, pl 73, f 4–6

3 **Arachnoidiscus indicus** Ehrenb, Ber Akad Berlin, 165 1854

Valves usually smaller than in *A. ehrenbergii*, with hyaline rays and large, rounded, irregular, areolate granules At the border are short costae on a hyaline, marginal zone Diam of v 90 µ

Type locality California Miocene

Distribution Marine Pacific Coast

Illustrations Ehrenb, Milkrogeol, pl 36, f 34, A Schmidt, Atlas, pl 68, f 6, pl 73, f 2

(Note It is probable that the name *Arachnoidiscus* was first given by Henry Deane in 1847 and was later adopted by Ehrenberg See Quart Jour Micr Sci, 188 1858)

13 STICTODISCUS Grev, Trans. Micr Soc. Lond 9 39. 1861

Frustules solitary, disc-shaped or prismatic Valves circular or angular, with coarse granules separated by radiating, hyaline lines, more evident near the margin where they often appear costate Distinguished from *Arachnoidiscus* chiefly by the absence of a central space

Type species, *Discoplea rota* Ehrenb

Valves orbicular or triangular Rays hyaline and anastomosing Cells rounded, in parallel rows at the border.	1. *S. harrisonianus*
Valves circular Rays anastomosing at the centre Puncta large, scattered, in groups of four at the border	2. *S buryanus*
Valves circular. Hyaline rays obscure at centre, more evident at border where they form quadrate cells	3 *S californicus*
Valves angular. Puncta scattered at centre, parallel at border	4 *S. parallelus*

1 **Stictodiscus harrisonianus** (Norm & Grev), Castr Rep. Voy Chall Bot. 2: 112 1886.
Triceratium harrisonianum Norm & Grev. Trans Micr Soc. Lond 9 76 1861

Valves orbicular or triangular, with straight or convex sides and sometimes slightly produced angles Costae hyaline, converging from the circumference and anastomosing, forming rounded cells with distinct central dot, scattered toward the centre and in radiating parallel rows at the circumference, alternating with the costae Central space sometimes hyaline, with a few smaller cells Border narrow, hyaline Diam 80–100 μ.

Type locality Barbados (fossil).

Distribution Marine, Campeche Bay

Illustrations: Trans. Micr. Soc Lond 9 pl. 9, f 9, A. Schmidt, Atlas, pl 75, f. 14–16, pl 81, f. 8, 9, 17; Walker & Chase, Notes Diat (2) 3 5 pl 4, f 4, 5 1887

2 **Stictodiscus buryanus** Grev Trans. Micr Soc Lond 9 40 1861

Valves circular, convex, with distinct rays anastomosing at the centre Puncta large, scattered, except at the border where they are smaller and form groups of three or four Diam 70 μ

Type locality Trinidad deposit

Distribution Marine. Key Biscayne, Fla Campeche Bay

Illustrations Grev, Trans Micr Soc Lond, 9 pl 4, f 1, 2; A Schmidt, Atlas, pl 131, f. 3

3 **Stictodiscus californicus** Grev, Trans. Micr Soc Lond 9 70 1861

Valves circular, with large puncta, 3 in 10 μ, with central dots Rays hyaline, obscure near the centre, becoming more evident toward the border where they divide the marginal zone into quadrate cells Border narrow, with small granules on the margin Diam 85 μ

Type locality California Miocene

Distribution Marine. Pacific Coast Campeche Bay

Illustrations Grev, Trans Micr. Soc Lond 9 pl 10 f 1, A Schmidt, Atlas, pl 74, f 4, 5, 9

4 **Stictodiscus parallelus** (Grev) Castr Rep Voy Chall Bot 2 112 1886.

Valves angular, with straight or convex sides Puncta rounded, parallel at the border, scattered or sometimes concentric at centre which usually shows a fine reticulation, and smaller at the angles

Greville's forms as originally described (Trans Micr Soc Lond., 104 1865) are quadrate or hexagonal and do not occur living. on the American coast The following forms are considered as varieties belonging to this species

Stictodiscus parallelus trigonus (A Schmidt) *Triceratium parallelum* form *trigona* A Schmidt, Atlas, pl 76, f 14 (not pl 75, f. 11, 12) Valves triangular, with convex sides The hyaline reticulations not evident in small specimens A secondary, finely punctate layer is occasionally noticed This form does not show the costate markings of the true Stictodisci

Stictodiscus parallelus balearicus (Grun) (*Triceratium parallelum* var *balearica* Grun , A Schmidt. Atlas, pl 81, f. 2) Valves quadrate, with concave sides and rounded angles. Puncta parallel at the border, somewhat concentric at the centre and irregular and smaller at the angles Diam 58 µ.

Stictodiscus parallelus coloniensis (Grun). *Triceratium parallelum* var. *coloniensis* Grun A Schmidt, Atlas, pl. 81, f 1 Valves quadrate, deeply concave or cruciform A central space with scattered or somewhat concentric granules

All of the above forms are found at Panama, on the coast of Florida, and in Campeche Bay.

The classification of forms of *Triceratium* is admittedly difficult Those here placed under *Stictodiscus* are apparently intermediate between true Stictodisci with evident costae and a very large group heretofore known for the most part as *Triceratia* For further discussion see under *Biddulphia*

Doubtful Species

Stictodiscus gelidus Mann Contr U S. Nat Herb 10^5 268 1907

Valves circular Surface divided into large, angular or rounded cells, 10 µ in diam. at the centre, decreasing to the border At the centre a small cell with central pore From "12–18" rays proceed from the circumference disappearing about half way to the centre Diam of v. 58–105 µ (Mann, in part) The structure appears, from the description and figure, to be near that of a Radiolarian

Type locality Bering Sea

Distribution Marine. Known only from the type locality

Illustrations Contr U S Nat Herb 10^5 pl 50, f 5

14. **ASTEROLAMPRA** Ehrenb Ber Akad Berlin 1844 73 1844

Frustules disc-shaped Valves circular, with straight or slightly curved, hyaline lines or costae radiating from the centre to the subtriangular, punctate, equal segments on the circumference Valves appear hyaline between the rays and on the border between the segments

Type species, *Asterolampra marylandica* Ehrenb

1 **Asterolampra marylandica** Ehrenb , Ber Akad Berlin 76. 1844.

Asterolampra impar Shadb , Trans Micr Soc Lond 2 17 1854

Valves circular, plane, with straight or slightly curved, sometimes dichtomous rays, 4–12, from the centre to the convex segments which are usually about one-half the radius in width Central part and spaces between the segments hyaline, the segments and border with cellular markings in oblique and curved rows Diam 75 µ The apparent hyaline central part is minutely and subtly punctate

Type locality Nottingham, Md Miocene deposit

Distribution Marine Pacific Coast Coast of Barbados

Illustrations Bailey, Amer Jour Sci 48 pl 4, f B (1845), Brightwell, Quart Jour Micr Sci 8 pl 5, f. 3 1860, Wallich, Trans Micr Soc. Lond 8 pl. 2, f 14, 15 1860, Grev Trans Micr Soc Lond 8 pl 3, f 1–4 1860, 10 pl 7, f 1–3 1862, Shadb Trans Micr Soc Lond 2 pl 1, f 14 1854

15 ASTERÓMPHALUS Ehrenb Ber Akad Berlin 1844 198 1844

Frustules disc-shaped Valves plane or slightly convex, circular or ovate, with rays proceeding irregularly from the centre, two approximate, usually curved, bent in zigzag or dichotomous, and meeting the quadrangular, trapezoidal or irregular, marginal segments which vary in size and number The hyaline space between two segments is narrowed and the rays approaching them are approximate Segments cellular, the cells smaller toward the margin and in oblique rows Border hyaline Chromatophores numerous round discs, variable in size

Type species, *Asteromphalus darwinii* Ehrenb

Valves circular or ovate Rays branching, curved, bent or straight Approximate segments with oblique margins	1 *A brookei*
Valves subcircular, hyaline centre excentric Rays zigzag Segments unequal Interspaces with lunate line at border	2. *A heptactis*
Valves circular Rays branched, slightly curved or bent Lateral segments equal. Interspaces expanded at ends	3. *A variabilis*
Valves subcircular or ovate. Hyaline area small, excentric Interspaces expanded at ends	4 *A arachne*
Valves ovate Hyaline area half the diameter Interspaces narrow, not expanded	5 *A flabellatus*
Valves orbicular Hyaline area half the diameter Centro-lateral area clavate, with umbilical, unbranched lines	6. *A atlanticus*
Valves circular. Hyaline area central, half the diameter. Interspaces 6–9	7. *A. hookeri*
Valves circular. Hyaline area central, half the diameter Interspaces 12.	8 *A vanheurckii*
Valves circular. Hyaline area excentric. Interspaces 5	9. *A. nanus*

1 **Asteromphalus brookei** Bailey, Amer Jour Sci 22 2 1856

Asterolampra brookei (Bail) Grev , Trans Micr Soc Lond 8 119 1860

Valves circular or ovate, with rays variously branching, curved bent or straight Segments with curved or straight margins toward the centre, about half the radius in width, the two approximate segments usually larger, with margins oblique toward the centre The cells on the inner margins of the segments 6–7 in 10 µ, decreasing to 10 in 10 µ at the border Diam 75 µ

Type locality Kamtschatka.

Distribution Marine Behring Sea Atlantic Ocean

Illustrations Bailey, Amer Jour Sci 22 pl 1, f 1, Pritchard, Infusoria (1861), pl 5, f 79, Trans Micr Soc Lond 8 pl 4, f 18 (1860), A Schmidt, Atlas, pl 38, f 21–23, Perag Diat Mar Fr pl 110, f 6

2 **Asteromphalus hepatctis** (Bréb) Ralfs in Pritchard Infusoria 838 1861

Spatangidium hepatctis Bréb Bull Soc Linn Normandie 2 296 1857
Spatangidium ralfsianum Norm Quart Jour Micr Sci 7 161 1859
Asterolampra heptactis (Bréb) Grev Trans Micr Soc Lond 8 122 1860
Asteromphalus beaumontii Ehrenb A Schmidt, Atlas pl 38 1876
Asteromphalus ralfsianus Grun , A Schmidt, Atlas, pl 38 1876

Valves subcircular, with the hyaline area excentric From two approximate rays proceed short, zigzag rays to the segments which are large, unequal and extend nearly to the centre on one side and to within one-third of the radius on the other The two approximate segments connected by the two approximate rays The hyaline interspace between each segment is marked by a lunate line at its extremity which indicates a convexity shown in zone view, with a small process, somewhat as in *Aulacodiscus*

Type locality Peruvian guano

Distribution Marine Gulf of California. North Atlantic

Illustrations Bréb. Bull Soc Linn Normandie 2 pl 3, f 2, Pritchard, Infusoria, pl 8, f 21, Quart Jour Micr Sci 7 pl 7, f 7, 8, A Schmidt, Atlas, pl 38, f. 5–8

3 **Asteromphalus variabilis** (Grev) Rattray Proc. Roy Soc Edinb 16 207 1890

Asterolampra variabilis Grev , Trans Micr Soc Lond 8 111 1860

Valves circular. Rays dichotomous or trichotomous, straight curved or bent, two somewhat parallel. Segments extending to one-half the radius from the border, equal, except the two subtending the sub-parallel rays and which are obliquely truncate. Diam 54–125 µ Markings subtle The interspaces between the segments slightly expanding at their extremities.

Type locality California Miocene deposits.

Distribution Marine Gulf of California Connecticut

Illustrations. Trans. Micr. Soc. Lond. 8. pl 3, f 6–8.

4. **Asteromphalus arachne (Bréb) Ralfs, Pritchard Infusoria, 837 1861**

Spatangidium Arachne Bréb , Bull Soc Linn Normandie 2 296 1857
Asteromphalus malleus Wallich, Trans. Micr Soc Lond 8 47 1860
Asterolampra arachne Grev , Trans Micr Soc Lond 8 123 1860

Valves subcircular or ovate Hyaline area small, excentric. Rays nearly parallel, from the two approximate segments, cross to the opposite segment and are connected by single rays to the two lateral segments Interspaces between the five segments expanded near the border Markings cellular, 6–7 in 10 μ. Diam. 45–60 μ.

Type locality Peruvian guano

Distribution Marine Pacific Coast Vancouver

Illustrations Bull. Soc Linn. Normandie 2 pl 3, f 1, Trans Micr Soc. Lond. 8 pl 2, f. 11, A Schmidt, Atlas, pl. 38, f 3, 4

5 **Asteromphalus flabellatus (Bréb) Grev Quart Jour Micr Sci 7 160 1859**

Spatangidium flabellatum Bréb , Bull Soc Linn Normandie 2 297 1857
Spatangidium peltatum Bréb , Bull Soc Linn Normandie 2 298 1857

Valves ovate Hyaline area about one-half the diameter. Nearly parallel rays from approximate segments connected by single rays to the lateral segments which are usually from six to nine Interspaces rather narrow, not expanded, slightly attenuated at the border Markings not distinct Diam 40–60 μ

Type locality Peruvain guano

Distribution Marine Campeche Bay

Illustrations Bull. Soc Linn Normandie 2 pl 3, f 3, 4, Quart. Jour. Micr Sci 7 pl. 7, f 4; A Schmidt, Atlas, pl 38, f 10–12

6. **Asteromphalus atlanticus Cleve, Bih Sv Vet Akad Handl 22 (3) 5 1896**

Valves orbicular, with 6–7 segments, truncate inside, the puncta forming rows parallel to the margin, and oblique rows, 12 in 10 μ. Hyaline area about half the diam of the disc. Centro-lateral area clavate, reaching a little beyond the centre of the valve and sending off, partly from the sides, partly from the top, umbilical lines which are unbranched and either nearly straight or angularly bent in the middle Diam. 30–40 μ. (Cleve) Resembles, according to Cleve, *A. brookei* Bailey, in A Schmidt, Atlas, pl. 38, f 9

Type locality Baffin Bay

Distribution Marine Plankton of Cumberland Sound (Cleve).

7 **Asteromphalus hookeri Ehrenb. Ber Akad Berlin 1844 200. 1844**

Asteromphalus cuvierii Ehrenb , Mikrogeol pl 35 1854
Asteromphalus humboldtii Ehrenb., Mikrogeol pl 35 1854
Asterolampra hookeri (Ehrenb.) Grev , Trans Micr Soc Lond 8 114 1860

Valves circular or nearly so. Segments 6–9, slightly rounded inside Markings punctate, in rows parallel or nearly so to the margin and decussating in oblique lines, larger or more prominent on the inner borders of the segments, 6 in 10 μ, and decreasing to about 10 in 10 μ at the border of the valve Central area with straight rays, the two approximate nearly parallel. Interspaces broad, slightly narrowed outwards, the interspaces between the approximate segments narrow Diam 64–120 μ

Type locality Antarctic Ocean

Distribution Pacific Coast; rare northward.

Illustrations Mikrogeol pl 35, A, 21, f 1, 2, 3, Pritchard, Infusoria pl 11, f. 34; A Schmidt, Atlas, pl. 38, f 18–20

8 **Asteromphalus vanheurckii** Mann, Contr U S Nat Herb 10^5 276 1907

Valves circular. Segments 12, slightly rounded inside Markings punctate, about 11 in 10 μ, parallel or nearly so to the margin of the valve, coarser and more prominent on the inner borders of the segments. Central area with rays straight or nearly so, the two approximate nearly parallel. Interspaces between the segments rather narrow, slightly dilated at the ends, with a terminal punctum Diam. 88 μ This form differs apparently from *A hookeri* in the number of segments and in the slightly narrower interspaces.

Type locality Coast of California

Distribution Marine Known only from the type locality

Illustrations Contr U S Nat Herb. 10^5 pl. 45, f 5

9 **Asteromphalus nanus** Mann Contr U S Nat Herb 10^5 276 1907

Valves circular. Central area slightly excentric, with five rays straight or nearly so Segments five, unequal, with concave inner borders Markings punctate, 13–15 in 10 μ, decreasing to the border Interspaces rather broad, more or less curved, with a punctum at the end, the narrow interspace dividing the approximate segments unequally Diam 40–60 μ (Mann, in part)

Type locality Bering Sea

Distribution Marine Known only from the type locality

Illustrations Contr U S Nat Herb 10^5 pl 45, f 4

3 Eupodisceae

(a). Aulacodiscinae. Valves with mammiform processes
(b). Eupodiscinae Valves with ocelli

(A) AULACODISCINAE

Aulacodiscus Valves usually circular, with two or more inflations or processes on or near the border

16. **AULACODISCUS** Ehrenb, Ber Akad Berlin 1844 73 1844. em Rattray, Jour Roy Micr Soc 8 339 1888

Valves circular (in American species) Surface flat in central part and elevated or inflated at the processes Central space round or irregular, sometimes absent Markings rounded, angular or reticulate, in usually more or less straight, radiating rows, more pronounced along the furrows which are frequently found between the centre and processes Processes quite variable in number, usually conspicuous, cylindrical, constricted at the base

Type species, *Aulacodiscus crux* Ehrenb (fossil)

Most of the species described are fossil The American recent forms are included in the following divisions of Rattray.

Complanati Surface flat to processes Primary rays not elevated	
Markings more or less concentric	1 *A browne*i
Markings distinctly concentric	2 *A concentricus*
Areolati Surface flat, sloping to the border Markings pearly, in radial rows	
Furrows distinct	3 *A. margaritaceus*
Furrows indefinite	4 *A berringensis*
Spectati Surface flat at centre, elevated at processes but not inflated	
Markings without interspaces	5 *A oregonus*
Markings with interspaces	6 *A laxus*
Inflati Surface flat at centre, inflated at the processes	7 *A petersii*
Retiformes Markings both reticulate and granular	8 *A argus*
Blanditi Inflations distinct. Markings polygonal, in contact.	9 *A kittonii*

1 **Aulacodiscus brownei** Norman Ralfs in Pritchard Infusoria 844 1861

Aulacodiscus probabilis A Schmidt, Atlas, pl 36 1876

Valves circular, with central space small, irregular, hyaline, sometimes connected with the processes by indistinct, hyaline lines. Surface flat to zone of processes. Markings round, irregular at the centre, 5 in 10 µ, frequently in bent rows Border narrow, with striae 12 in 10 µ. Processes usually two, sometimes three, about one-fourth the radius from the circumference, having a clear space at each base Diam of v 75 µ

Type locality California coast

Distribution Marine Pacific Coast.

Illustrations A Schmidt, Atlas, pl 36, f 15, 16, pl. 105, f. 6.

2 **Aulacodiscus concentricus** (Mann.)

Tripodiscus concentricus Mann, Contr U S. Nat Herb 10^5 278 1907.

Valves circular, with small, irregular, hyaline centre. Surface "nearly flat for one-half the radius." Markings rounded, about 5 in 10 µ, equal to "within one-fifth a radius length of the margin," nearly concentric, then decreasing to the border in strictly radial rows which form a broad border of concentric circles Processes two or three, "stout, spherical, placed at about one-sixth a radius from the margin," with a hyaline area at the base, furrows somewhat obscure Border narrow, with small granules. Diam of v 65–133 μ (Mann) Near *A brownei* from which it appears to be distinguished by the more concentric markings

Type locality Monterey Bay, Cal

Distribution Marine. Known only from the type locality

Illustrations Contr U S Nat Herb 10^5 pl 54, f 1, 2

3 **Aulacodiscus margaritaceus** Ralfs Pritchard Infusoria 844 1861

Valves plane to the processes Central space usually small, irregular. Markings polygonal, about 4 in 10 μ at the centre, slightly larger at the semi-radius and decreasing to about 6 in 10 μ at the border Processes usually 3–6 Border narrow, with striae about 8 in 10 μ Diam of v 100–300 μ (See A Schmidt, Atlas pl 105)

Type locality Peruvian guano

Distribution Coast of California Campeche Bay

Illustrations A Schmidt, Atlas, pl 37, f 1–5

Several varieties are reported from California but it is uncertain whether they are recent or fossil

4 **Aulacodiscus beringensis** (Mann)

Tripodiscus beringensis Mann, Contr U S Nat Herb 10^5 278 1907

Valves circular, nearly flat, with rounded, hyaline centre Markings rounded, about 6 in 10 μ, slightly decreasing toward the border. Inflations low, with 12 processes, "from the base of each, a hyaline rectangular space, two rows of beads wide, extending radially inward for about one-fifth the radius, from this point a single row of beads running to the small circular central area" Diam of v 63 μ. (Mann)

Type locality. Bering Sea

Distribution Marine Known only from the type locality

Illustrations Contr U S Nat Herb 10^5 pl 50, f 6

5 **Aulacodiscus oregonus** Harvey & Bailey Proc Acad Phila. 6 430 1853

Aulacodiscus oregonensis Harv & Bail, U S Expl Exp 17 176 1862

Valves circular. Central space round, punctate and granular. Surface slightly concave at centre and rising gradually to the zone of the processes, forming low inflations with concave interspaces and descending abruptly to the border. Markings round, 4 in 10 μ, slightly diminishing to the border. Primary rows straight, secondary rows parallel between the processes, with granulate interspaces of the secondary striation. Processes large, usually 9–12, sometimes 20 or more, slightly constricted, with minute, clear spaces at the base Border narrow, with striae 12 in 10 μ Diam.

of v quite variable to 235 μ. Abnormal forms occur in which the valve is divided symmetrically into two equal parts, each with a hyaline centre, and, in other cases, in which several hyaline centres are found (Boyer, Bull Torr Club 47 71. pl 2, f 5. 1920)

Type locality Puget Sound

Distribution Marine Pacific Coast

Illustrations U S Expl Exp 17 Algae pl 9, f 6, Grev, Quart. Jour Micr Sci 7. pl 7, f 2, A Schmidt, Atlas, pl. 34, f 4, 5.

6 **Aulacodiscus laxus (Mann)**

Tripodiscus laxus Mann, Contr U S Nat Herb 10^4 280 1907

Valves circular, concave to the base of processes and abruptly descending to the border. Central space small Markings rounded, equal in the centre, 4½ in 10 μ, in radiating rows, decreasing at the border, with wide interspaces Processes 5, one-sixth the radius within the border, with a hyaline area at the base Diam of v. 76 μ (Mann, in part)

Type locality Bering Sea.

Distribution Marine Known only from the type locality

Illustrations Contr U S Nat Herb 10^4 pl 54, f 3

7 **Aulacodiscus petersii** Ehrenb Ber Akad Berlin 361 1845

Aulacodiscus petersii notabilis Rattray, Jour Roy Micr Soc. 8 366 1888

Valves circular or subcircular, central space small, rounded, hyaline Surface flat in the centre, inflated gradually to the processes, the intervening spaces nearly flat Inflations broad, about one-third the radius at the ends which descend rapidly to the border. Markings polygonal, 6 in 10 μ at the centre, diminishing to 8 in 10 μ and becoming moniliform at the border Primary rays intermediate between the processes straight Border striae 10 in 10 μ Apiculi numerous on central portions and the inflations, absent on the intervening spaces Processes usually five, constricted, hyaline spaces at the base small Diam of v 135 μ

Type locality Africa

Distribution Marine Pacific Coast Colon Vera Cruz.

Illustrations A. Schmidt, Atlas, pl 35, f 1–4

A. petersii appears to be the sole survivor at Colon and Vera Cruz of the genus *Aulacodiscus*, formerly so abundant, as Cleve remarks, in the West Indies, but now entirely absent

8 **Aulacodiscus argus (Ehrenb.) A. Schmidt, Atlas, pl 107. 1886**

Tripodiscus argus Ehrenb, Ber Akad Berlin, 159 1839

Eupodiscus argus (Ehrenb.) W. Smith, Syn Brit Diat 1 24. 1853.

Valves circular Central space absent. Surface flat to near the border or slightly convex Markings a reticulation of radiating, angular cells, about 2 in 10 μ, the outer layer and radiating rows of round granules, 3–4 in 10 µ, with hyaline interspaces, closer at the border, forming the inner layer, scarcely visible through the reticulum but frequently found detached The walls of the cells crossed by fine lines In moderately opaque valves the general appearance is that of triangular cells with 2–3 granules but the structure is not evident except when the layers are separated. Border narrow and indistinct, with striae 8 in 10 µ Processes 3–6, long and robust, inserted at from one-fifth to one-fourth the radius from the border, without hyaline spaces at the base

Type locality Europe

Distribution Marine. Atlantic coast, especially southward.

Illustrations Van Heurck, Syn Diat Belg , pl 117, f. 3–6, A. Schmidt, Atlas, pl 92, f. 7, pl 107, f 4, Boyer, Diat Phila , pl. 4, f 8

9 **Aulacodiscus kittonii** (Arnott Ms) Ralfs in Pritchard Infusoria 844 1861

Valves circular Surface flat to one-third the radius, rising at the processes and concave between them Central space a rosette of angular cells. Markings angular, without interspaces, 4–5 in 10 µ, radiating in irregular rows the cells in pairs on the furrows Inflations mammillate, the processes 3–8, usually 4, with a dark, crescentic line next to the border Border narrow, the striae indistinct Diam of v variable to 230 µ

Type locality New Zealand

Distribution Marine and brackish Pacific Coast

Illustrations Ralfs, in Pritchard, Infusoria, pl 8, f 24, A Schmidt, Atlas, pl 36, f 3, 4, 6, 7, 8

Species Reported

Aulacodiscus affinis Grun , in A Schmidt, Atlas, pl 34, f 9, 10. 1876. Reported by Mann (as *Tripodiscus affinis* (Grun) Mann, Contr U S. Nat Herb 10^{5} 278 1907) as occurring in hydrographic soundings in Bering Sea This form which occurs in the fossil deposits of California has not been recorded as recent

Tripodiscus cosmiodiscus Mann, Contr U S. Nat Herb 10^{5} 279. pl. 54, f 4 1907 Valves circular, nearly flat Central space absent Markings minute, 13 in 10 µ, radiating Processes 12, each "consisting of a prolongation of a single row of beads, this within one-sixth a radius of the margin, becoming a narrow hyaline ridge crowning the twelve slightly protuberant portions of the valve and terminating in an exceedingly small but evidently spherical process." This form, apparently, cannot be included under *Aulacodiscus*. It is, according to Mann, somewhat like

Cosmoidiscus barbadensis Grev which, according to Rattray, may be identical with *Coscinodiscus neogradensis* Pant Bering Sea. (Mann)

(B) EUPODISCINAE

1 *Actinocyclus* Markings granular or punctiform, in radial, sometimes fasciculate rows A small nodule near the border

2 *Euodia* Valves semicircular Markings granular, in radial, irregular or decussating rows A small nodule near the border of one valve

3 *Roperia* Markings cellular, irregular An ocellus near the border

4 *Eupodiscus* Markings cellular, irregular Several large ocelli near the border

5 *Auliscus* Markings costate and granular. Large ocelli near the border

6 *Pseudauliscus* Markings radiate granules Ocelli large

7 *Rattrayella* Markings minute puncta in radiating lines. Ocelli small

17 **ACTINOCYCLUS** Ehrenb Abh Akad Berlin 61 1837 em Rattray Jour Quek Club Ser 2 4^n 137 1890

Valves circular or elliptical Surface convex, flat in the centre, occasionally with undulating zones of elevation Central space more or less evident, circular or irregular, usually with a few scattered granules Markings areolate or granular, round or punctiform, in radial, interrupted, sometimes fasciculate rows which are either straight or slightly curved, parallel to the central rows or to a marginal row Markings larger at the centre or sometimes slightly increasing to the semi-radius and then decreasing gradually or suddenly and forming a marginal portion of decussating lines Interspaces opposite the shorter rows frequently give rise to the appearance of zones, at the border the hyaline interspaces are sometimes prominent Border usually distinct, hyaline or finely striated. Within the border apiculi are often present and at a variable distance from it is found a pseudonodule which may be, according to Rattray, plano-convex, truncato-conical, cylindrical or indefinite The nodule is apparently a lenticular thickening of the silex.

Type species, *Actinocyclus octonarius* Ehrenb.?

The following analysis is condensed from Rattray's monograph,

Coscinodiscoidales (Rattray) Markings areolate, coscinodiscoid.	
Central space absent Markings fasciculate toward the border	1 *A. alienus*
Central space distinct Markings fasciculate in slightly curved rows	2. *A subocellatus*

Radiolati (Rattray) Markings granulate or angular, radiate
  Central space irregular Markings in short, irregular rows 3 *A subcrassus*
Zonulati (Rattray) Markings granular, radiate, in more or less distinct zones
  Central space round or irregular. Surface divided into zones by hyaline interspaces 4 *A ralfsii*
  Central space irregular Markings decreasing to border where they form moniliform striae 5 *A barklyi*
Fasciculati (Rattray) Markings actinocycloid, fasciculate
  Central space small Hyaline interspaces appear as double lines 6 *A fasciculatus*
  Central space absent or minute Markings in fasciculate rows, about ten in each fasciculus 7 *A americanus*
  Central space irregular Surface undulating 8 *A ehrenbergii*
  Central space irregular Markings suddenly reduced to a submarginal zone, without zonulate arrangement 9 *A moniliformis*
  Central space small. Markings delicate, indistinct 10 *A tenuissimus*
Subtiles (Rattray) Markings indistinct, punctate
  Central space rounded Markings largest at centre, in somewhat flexuose lines Hyaline interspaces obscure 11 *A subtilis*
  Central space irregular Markings in flexuose lines at centre, curved near the border 12 *A niagarae*

1 **Actinocyclus alienus arcticus** Grun In Van Heurck Syn Diat Belg pl 125 1881

Central space absent Markings areolate, 9–10 in 10 μ, smaller at the border, in fasciculate rows, less evident except toward the border, the rows parallel to those in the middle Apiculi indistinct, at irregular intervals Border hyaline Pseudonodule close to the border, small Diam 50 μ Color pale gray

Type locality Cape Wankarema

Distribution Marine Arctic Sea Davis Strait Hudson Strait.

Illustrations Van Heurck, Syn Diat Belg, pl 125, f 12

2 **Actinocyclus subocellatus** (Grun) Rattray Jour Quek Club Ser 2 4^{27} 145 1890
Actinocyclus curvatulus Janisch, A Schmidt, Atlas, pl 57 1878
Coscinodiscus curvatulus var ? *subocellata* Grun Denks Akad Wien 48 83 1884

Central space distinct, irregular, with a few scattered granules Markings areolate, hexagonal, 6 in 10 µ near the centre, decreasing to 9 in 10 µ at the border, in fasciculate, slightly curved rows parallel to a marginal row Border rather wide, with short striae evident near the edge, 12 in 10 µ Pseudonodule close to the border, indefinite, with a few granules in the centre Diam 115 µ (Specimen from Kerguelen Land) Color pale gray

Type locality Peruvian guano.

Distribution Marine Vancouver, B. C

Illustrations Grun , Denks. Akad. Wien. 48 pl 4, f 15, A. Schmidt, Atlas, pl 57, f 31.

3 **Actinocyclus subcrassus** Rattray Jour Quek. Club, Ser 2, 4: 154 1890

Actinocyclus crassus (W Smith) Ralfs, in Van Heurck, Syn Diat Belg , 215 1885 (Not *Eupodiscus crassus* W Smith)

Central space irregular. Markings granular, in short, irregular rows, 8 in 10 µ, decreasing near the border and there forming a submarginal zone with puncta in quincunx, 18 in 10 µ. Border distinct Pseudonodule well defined, near the inner margin of the submarginal zone Diam 45 µ

Type locality Belgium

Distribution Marine Leete's Island, Connecticut.

Illustrations Van Heurck, Syn Diat. Belg , pl 124, f 8

4 **Actinocyclus ralfsii** (W Smith) Ralfs, in Pritchard, Infusoria 835 1861

Eupodiscus ralfsii W Smith, Syn Brit Diat 2 86 1856
Coscinodiscus fuscus Norman, Trans. Micr Soc Lond , 9 7 1861

Central space round or irregular, with scattered granules Surface flat to near the semi-radius, divided into zones by hyaline interspaces at the beginning of shorter rows The central zone includes single rows of granules, 9 in 10 µ The successive zones include in each the addition of a secondary row of granules, intermediate, beginning at the hyaline interspaces and diminishing toward the border where they become resolved into decussating, oblique lines of granules, 12 in 10 µ The number of zones depends upon the size of the valve Pseudonodule large, circular, on the outer edge of the decussating lines. Border narrow, striated. Diam quite variable Color varies in zones, chiefly light blue, yellow, grey or brownish

Type locality England.

Distribution Marine. Atlantic and Pacific Coasts

Illustrations Trans Micr Soc Lond. 9 pl 2, f. 3 Van Heurck, Syn Diat Belg pl. 123, f. 6

5 **Actinocyclus barklyi** (Coates)

Coscinodiscus barklyi Coates, Quart Jour Micr. Sci. Ser 2 1: 138. 1861
Actinocyclus barklyi (Ehrenb) Grun , in Rattray, Jour. Quek Club, Ser 2 4: 158 1890 The specific name originated with Coates
Actinocyclus fuscus Norman, in H L Smith, T S 11

Valves flat to about one-third the radius from the border Central space well defined, irregular, with several granules Markings moniliform, radiate, 5–6 in 10 µ at the centre, 7–8 in 10 µ at the semi-radius and suddenly decreasing near the border to 12 in 10 µ. Hyaline interspaces at the origin of intermediate rows not zonulate. Near the border the hyaline spaces are well defined, narrow, and at regular distances apart Pseudonodule close to the inner edge of the border, inconspicuous Border narrow, with striae, 12 in 10 µ. Color dark brown in centre, pale grey at the border Diam to 130 µ.

Type locality Yarra Yarra, Australia.

Distribution Brackish water Connecticut Mobile, Ala.

Illustrations Van Heurck, Syn Diat Belg pl 124, f 12.

Actinocyclus barklyi aggregatus Rattray, Jour. Quek. Club, Ser. 2, 4 159. 1890 Markings smaller than in type, 7–9 in 10 µ at the centre, 12 in 10 µ near the border. Border striae 16 in 10 µ. Pseudonodule small, usually near the border. Boyer, Diat Phila., 27. pl. 6, f 1. 1916 Connecticut Philadelphia. The specimen figured clearly shows on examination, contrary to Rattray's description, the nodule distant from the border, but otherwise it corresponds

6 **Actinocyclus fasciculatus** Castr Rep Voy Chall Bot 2 144 1886

Valves circular. Central space small, rounded or angular. Surface flat to submarginal, convex zone and descending suddenly to border. Markings granular, 10 in 10 µ, nearly equal to a submarginal zone, in fasciculate rows, the secondary rows in each fasciculus decussating, reduced on the marginal zone to 15 in 10 µ, in rows oblique to the border. The hyaline interspaces on each side of the interfasciculate rows appear, under low magnification, as double lines. Apiculi sometimes present, minute, interfasciculate. Pseudonodule evident, with an irregular areola, on the submarginal zone, at varying distances from the border Border well defined, striated. Color light bluish grey in the centre, darker toward the margin which is brownish

Type locality Richmond, Virginia (fossil).

Distribution Marine. Atlantic and Pacific Coasts

Illustrations. Castr., Rep. Voy Chall. Bot 2 pl. 4, f 8.

7 **Actinocyclus americanus** Perag., Tempère and Perag. Diat. du Monde entier 65 1915

Valves circular. Central space absent or minute. Surface flat to the submarginal zone. Rows of markings fasciculate, about ten in each fasciculus, the markings granular, 12–14 in 10 µ in the middle to 16 in 10 µ at the border Apiculi interfasciculate Border narrow. Pseudonodule distant from the border, surrounded by a hyaline area 2–3 μ in diameter Diam usually about 45 μ Color brownish purple

Type locality Port Townsend, Wash

Distribution Marine. Pacific Coast northward Not rare

8 **Actinocyclus ehrenbergii** Ralfs in Pritchard Infusoria 834 1861

The synonymy includes about one hundred and twenty-three species named by Ehrenberg and distinguished almost entirely by the number of rays which vary from three to one hundred and twenty

Central space irregular, with crowded granules surrounded by an irregular, hyaline area. Surface of valves undulating, depressed in the centre, rising for one-fourth of the radius, then slightly depressed and again rising at one-fourth of the radius from the border and then descending, varying, however, in the zones of elevation in proportion to the size of the valves Markings granular, with central dots, 8 in 10 μ, decreasing to 10–12 at the border, radiating in flexuose lines, the interfasciculate rows having hyaline spaces on each side at the origin of secondary rows, giving the appearance of double lines of radiation The shorter rows begin at unequal distances from the centre and the zonulate arrangement of the hyaline spaces is obscure Border narrow, the striae 14–20 in 10 μ The shorter rows are parallel to the central rows and less flexuose than the interfasciculate rows Pseudonodule distinct, circular, close to the border and surrounded by an irregular, hyaline area Minute apiculi sometimes present, close to the border Diam quite variable Under low magnification the varying elevations of the surface produce a beautiful iridescence

Type locality Peruvian guano

Distribution Marine. Atlantic and Pacific Coasts

Illustrations Ehrenb, Mikrogeol, innumerable figures, Van Heurck, Syn Diat Belg, pl 123, f 7

9 **Actinocyclus moniliformis** Ralfs, in Pritchard Infusoria 834 1861

Eupodiscus minutus Hantzsch in Rab Beitr Alg 1 21 1863
Eupodiscus tenellus Bréb, Mém Soc Sci Nat Cherbourg, 2 257 1854

Centre irregular, with crowded granules Surface plane to near the border Markings granular, 8 in 10 μ, but suddenly reduced on a broad submarginal zone to 12 in 10 μ Interfasciculate rows straight, the shorter rows parallel to the central rows, with evident hyaline spaces at their origins which are at variable distances from the centre and without zonulate arrangement Border narrow, with delicate striae Pseudonodule circular, distinct, close to the inner edge of submarginal zone, surrounded by a circular, hyaline area Diam quite variable Differs from *A ehrenbergii* in the straight interfasciculate lines and in the prominence of the submarginal zone. It does not show the double arrangement of the hyaline interspaces On the submarginal zone narrow, hyaline, interspaces are sometimes present, with distinct, interfasciculate apiculi In small forms with few fasciculi the distinctions between *A*. *ehrenbergii* and *A moniliformis* apparently disappear Color pale grey at the centre and on the marginal zone, with, sometimes, a bluish tint, the remainder of the valve a yellowish brown

Type locality Europe

Distribution Marine. Atlantic and Pacific Coasts

Illustrations Hantzsch, in Rab Beitr Alg 1 pl 6A, f 9, Bréb, Mém Soc Sci Nat Cherbourg, 2 pl 1, f 9, Van Heurck, Syn Diat Belg, pl 124, f 9, Boyer, Diat Philadelphia pl 6, f 2

10 **Actinocyclus tenuissimus** Cleve Bih Sv Vet Akad Handl 5^{8} 21 1878

Surface flat Central space small, rounded, with a few granules. Markings delicate, the puncta 22 in 10 µ, fasciculate, the fasciculi and shorter rows indistinct Pseudonodule evident, about one-sixth of the radius distant from the margin Border narrow, hyaline Apiculi numerous, usually prominent, attached to the border Diam 30–80 µ Color yellowish grey, darker in small valves Sometimes associated with *A subtilis*, the apiculi in some specimens similarly situated, extending into the frustules from the border The two are alike inasmuch as the apiculi in both are sometimes absent

Type locality Coast of Barbadoes.

Distribution Marine West Indies

Illustrations Cleve, Bih Sv Vet-Akad Handl 5^{8} pl 5, f 34, Van Heurck, Syn Diat Belg, pl 125, f 2

11 **Actinocyclus subtilis** (Greg) Ralfs in Pritchard Infusoria 835 1861

Eupodiscus subtilis Greg Trans Roy Soc Edinb 21 501 1857 See also H L Smith, Amer Jour, Micr 2 101 1877

Central space rounded, with crowded granules, somewhat concentric Surface rising slightly to within one-third of the radius from the circumference and gradually descending to the border Markings punctate, larger at the centre, about 15 in 10 µ, radial, somewhat flexuouse, fasciculate, the hyaline spaces at the origin of the shorter rows obscure Border well defined, narrow, hyaline Pseudonodule prominent, circular, surrounded by a large, circular area, distant from the border, usually about one-fifth of the radius. Apiculi usually present, interfasciculate, sometimes quite large, as in *Coscinodiscus polyacanthus* Grun which appears to be closely related to this species Diam 50–75 µ Color pale grey, with a slight yellowish tint, occasionally darker.

Type locality England.

Distribution Marine Caribbean Sea Pacific Coast.

Illustrations Greg, Trans Roy. Soc Edinb., 21: pl 11, f. 50; Van Heurck, Syn Diat Belg, pl 124, f 7.

Rattray remarks that *A. subtilis* varies with respect to the character of the central area, the appearance of the hyaline spaces, the prominence of the markings and the presence or absence of apiculi, which, in the case of specimens in H. L Smith's Type Slide 14, are 2 µ in length This form occurs also in Monterey Bay, (H. L. Smith Type Slide 168).

12 **Actinocyclus niagarae** H L. Smith, Amer Quart Jour Micr 1 17 1878

Central space irregular, with a few granules Surface inflated, slightly rising toward the border and then descending Markings punctate, 15 in 10 µ at the centre, 18 toward the border, in radiating lines, flexuose at the centre and curved near the border Hyaline spaces at the origins of intermediate rows obscure, except about half way to the circumference, where linear spaces alternate with double rows of punctate lines and produce the appearance of rays. Border narrow, apparently hyaline. Pseudonodule minute, on the inner edge of the border Apiculi on the convex edge of the valve, opposite each second or third hyaline interspace. Diam 60–110 µ Color greyish or hyaline

Type locality Lake Erie.

Distribution Fresh water Local to Lake Erie In Cleveland, Ohio, water supply

Illustrations H L. Smith, Amer. Quart Jour. Micr, 1 pl 3, f 10.

Doubtful Species

Actinocyclus oliverianus O'Meara, Jour Linn Soc Bot 15 58 1877. (*Podosira oliveriana* (O'Meara) Grun, in Van Heurck, Syn Diat. Belg, pl 118. 1881)

Valves slightly convex Central space absent. Markings hexagonal, 6–7 in 10 µ at the centre and decreasing in fasciculate rows to the border where they are 14 in 10 µ. The secondary, oblique, decussating rows sometimes slightly curved. Border 6 µ or more in width, striated, the striae about 14 in 10 µ, punctate. A small clavate process occurs on the inner edge of the border but, as Rattray remarks, it "is distinct in character from an ordinary actinocycloid pseudonodule." Diam. of v. 75 µ.

Type locality Kerguelen Land.

Distribution Marine Coast of Alaska (Mann.)

Illustrations Jour. Linn. Soc. Bot. 15 pl 1, f. 7; Van Heurck, Syn. Diat. Belg., pl 118, f. 5.

Grunow has proposed a new genus, *Micropodiscus*, to include this form and certain species of *Coscinodiscus* (Denks. Akad. Wien, 48 79 1884)

Species Reported

Actinocyclus elongatus Grun , in Van Heurck, Syn Diat Belg , pl. 125, f. 15, 17 1881 Reported by Mann (Contr U S Nat Herb. 10³ 262 1907) as occurring off the coast of southern California. As the species is possibly fossil it is not here included

18 **EUODIA** (Bailey MS) Ralfs in Pritchard Infusoria ed 4 852 1861

Frustules cuneate in zone view Valves semi-lunate Markings granular, in irregular or radiating rows A small nodule sometimes near the border of the ventral side on one of the valves

Type species, *Euodia gibba* Bailey

Valves semi-circular, gibbous on the ventral side	1 *E gibba*
Valves parabolic on the dorsal margin, gibbous on the ventral	2. *E inornata*
Valves straight on the ventral side	3. *E recta*

1 **Euodia gibba** (Bailey MS.) Ralfs in Pritchard Infusoria ed 4 852 1861

Valves semicircular, rounded at the ends and more or less gibbous on the ventral side Markings about 8 in 10 μ at the centre, diminishing in irregular, radial and decussating rows to about 15 in 10 μ at the border. Minute apiculi sometimes close to the border On the lower valve, but not on the upper is a small nodule like that in *Actinocyclus*, near the ventral margin Diam of v. 85, variable in outline *E ventricosa* Castr is near this form but appears to have finer puncta

Type locality Gulf Stream.

Distribution Marine Florida Campeche Bay Gulf of California

Illustrations Pritchard, Infusoria pl 8, f 22, Boyer, Diat Phila pl. 5, f 1.

2 **Euodia inornata** Castr Rep Voy Chall Bot 2 149 1886

Valves with dorsal margin parabolic and ventral margin slightly gibbous in the middle Markings granular, about 8 in 10 μ in the centre, diminishing in radiating lines to about 18 in 10 μ at the border. Apiculi not evident Diam of v 84 μ Scarcely distinct from *E. gibba* from which it differs chiefly in outline

Type locality. South Atlantic

Distribution Marine. Key Biscayne, Fla

Illustrations. Castr., Rep Voy. Chall Bot. 2 pl 12, f. 1.

3 **Euodia recta** Castr , Rep. Voy Chall. Bot. 2 140 1886

Valves with ventral side straight. Markings granular, radiating from a subcentral point, about 14 in 10 μ, at the centre, diminishing to about 18–20 in 10 µ at the circumference Nodule rather large Apiculi not evident Diam 132–147 µ Distinguished from *E gibba* by its straight ventral side and finer markings

Type locality South Atlantic

Distribution Marine Colon

Illustrations Castr Rep Voy Chall. Bot 2 pl 12, f 3

Species Reported

Leudugeria janischii (Grun) Tempère, (*Euodia janischii* Grun., Van Heurck, Syn Diat Belg , pl 127, f 1–4), Van Heurck, Treat Diat , 539, f 287 Frustules quadrangular, with broad connective zone, the puncta of which are coarse, in longitudinal lines Valves arcuate, with rounded ends, coarsely punctate, the puncta irregular, with finer, intermediate puncta Length of valve 97 µ One specimen only has been found on material from the Wilmington River, Ga , and, as it may be accidental, is not here included among the living forms It occurs fossil in the Weymouth, N J , deposit

19 **ROPERIA** Grun In Van Heurck Syn Diat. Belg pl 118 1891

Valves circular or somewhat elliptical Surface flat, except near the border Central space absent Markings areolate, hexagonal, in straight, decussating lines at the centre A pseudonodule near the border Distinguished from *Actinocyclus* by the absence of rays and from *Coscinodiscus* by the presence of a pseudonodule

Type species, *Eupodiscus tessellatus* Roper

1 **Roperia tessellata** (Roper) Grun , in Van Heurck Syn Diat Belg , pl 118 1881
Eupodiscus tessellatus Roper, Quart Jour Micr Sci 6 19 1858
Actinocyclus tessellatus Ralfs, in Pritchard, Infusoria ed 4 835 1861

Valves circular or nearly so Surface flat to within one-eighth of radius toward the border Markings areolate, hexagonal, in straight and decussating lines, 5 in 10 µ at the centre, becoming slightly fasciculate and diminishing to 10 in 10 µ at the sloping border Pseudonodule evident, 2–2½ µ in diam , distant from the border about its own diameter Border narrow, striated Diam 60–80 µ

Type locality England

Distribution Pacific Coast May occur on the North Atlantic Coast as it is found at Rio de Janeiro

Illustrations Quart Jour. Micr Sci 6 pl. 3, f 1, a, b, Van Heurck, Syn Diat Belg. pl 118, f. 6, 7

20. **EUPODISCUS** Rattray Jour Roy Micr Soc 8 909. 1888

Valves circular, plane Central space absent. Markings angular cells in radial or irregular rows Border prominent, striated. Processes usually large, circular or elliptical, near the border.

1 **Eupodiscus radiatus** Bail Smith Contr 2 30 1850

Aulacodiscus radiatus (Bail) Brightw (not Grev), Quart Jour Micr Sci 8 95 1860

Valves circular Markings hexagonal areolae 4 in 10 μ, in more or less radial, sometimes irregular rows, slightly convergent near the processes Border broad, coarsely striate on the inner margin and finely striate on the outer Processes 3-6, usually 4, circular or elliptical, close to the border Diam 45–156 μ Small specimens frequently show a crenulation of the margin next to the border and more convergent rows near the processes

Type locality Atlantic Coast

Distribution Marine Atlantic Coast, more common southward

Illustrations Quart Jour Micr Sci 8 pl 5, f 10, a, b, Boyer, Diat Phila pl 5, f 3, H I Smith, T S 164

Rattray's genus of *Eupodiscus* is not the same as that of Ehrenberg's the type species of which was what is now known as *Aulacodiscus argus* Bailey's form is neither an *Aulacodiscus*, *Auliscus* or *Pseudauliscus*, as these genera are now understood, and cannot be assigned to any one of them As but one species is recognized as recent in North America I have not ventured to change the name It is suggested, however, that if, according to the American code, it becomes necessary to place the species in a new genus that the genus be called *Baileya* in honor of the pioneer of American writers on the Diatomaceae The species which appears to be nearest to Bailey's is *Eupodiscus hardmanianus* Grev (Trans Mic Soc Lond 14 80 pl 8, f 14 1866), a fossil form from Barbados

21 **AULISCUS** Ehrenb Ber Akad Berlin 270 1843 Em Rattray Jour Roy Micr Soc 8 861 1888

Frustules cylindrical or subcylindrical Zone with longitudinal rows of fine puncta Valves circular, subcircular or elliptical, plane, except near the processes Central space more or less circular, sometimes irregular, hyaline Markings of two kinds, radiating or scattered granules and costae in radiating, curved lines, prominent or indistinct A secondary structure of minute puncta is observed on the inner layer Processes usually two, sometimes one to four, large, short, cylindrical, with hyaline or punctate surface, more or less elevated, with usually a hyaline or striated border The processes are near the ends of the major axis in a line oblique to it and never opposite those of the other valve. Chromatophores undetermined

Type species, *Auliscus americanus* Ehrenb ?

Rattray divides the genus into fourteen sections, of which six are represented in the recent forms of North America and may be stated as follows

Granulati Markings granular
  Valves elliptical. A fascia with parallel sides extending between the processes 1. *A clevei*
Striolati Markings delicate, inconspicuous striae
  Valves circular or nearly so Processes usually three, large, close to the border 2 *A caballii*
  Valves subcircular Large apiculi near the processes and the border 3. *A stoeckhardtii*
  Valves elliptical Surface punctate, more evident in a transverse area 4 *A punctatus*
  Valves subcircular Central space very large Markings granular or pruinose toward the border, with intermediate costate lines Processes three 5 *A hyalinus*
  Valves circular Striae delicate. Numerous apiculi between the processes Processes three 6 *A normanianus*
Lineolati Markings pruinose striae
  Valves circular or elliptical. Markings interrupted, curved or irregular, punctate lines 7 *A pruinosus*
  Valves circular Markings distinct, sometimes confluent, in punctate radiating lines 8 *A confluens*
Costati Markings distinct costae around the border.
  Valves elliptical or subcircular Markings delicate striae radiating from the centre and developing into costae at border 9 *A caelatus*
  Valves subcircular Markings coarse and and widely separated costae 10 *A sculptus*
  Valves subtriangular. Abruptly costate near the border. Costae sharply defined 11. *A floridanus*
Signati. Markings delicate striae near the border
  Valves circular Markings very fine. Apiculi scattered over the surface 12. *A macraeanus*
Retiformes Markings reticulate near the border or at the centre
  Valves subcircular. Surface divided into four lobes. 13. *A reticulatus*

Valves subcircular or subquadrangular Markings punctate striae anastomosing in a reticulum Processes four 14. *A speciosus*

Valves elliptical. Surface lobed. Markings forming a reticulum 15 *A schmidtii*

Valves orbicular Central part divided into two fan-like lobes with anastomosing costae 16 *A rhipis*

1 **Auliscus clevei** Grun A. Schmidt Atlas, pl 31 1875

Valves elliptical Surface flat but abruptly rising at the outer edges of the processes Central space round, hyaline. A fascia with parallel sides extends between the processes, hyaline at the inner bases Markings granular, the puncta 8 in 10 µ, in radiating and divergent rows. Processes two, mammillate, at a distance from the border equal to their diameter Diam of major axis 40–60 µ.

Type locality Campeche Bay.

Distribution Marine. Local to Campeche Bay

Illustrations A Schmidt, Atlas, pl 31, f. 1–4.

2 **Auliscus caballii** A Schmidt, Atlas pl 32 1875

Valves circular or nearly so Central space scarcely defined. Markings indistinct, punctate or interrupted striae somewhat converging around the processes Processes three, rarely two, large, circular or sub-circular, close to the narrow border Apiculi, usually two to six, are found near the border between each two of the processes Diam. 50 µ

Type locality Coast of Venezuela

Distribution Marine. Caribbean Sea

Illustrations A Schmidt, Atlas, pl 32, f 1, 2

3. **Auliscus stoeckhardtii** Janisch, Abh Schl Ges. Väterl Cult 163 1861

Valves subcircular Central space rounded. Markings radiating fine striae (secondary), converging at the processes, and large apiculi surrounding them and also in a triangular group on each side of the band between the processes and forming a single or double row within the border Processes two, somewhat irregular, with striated border at a distance of their diameter from the edge of the valve. Diam 80–125 µ

Type locality. Coast of Peru.

Distribution Pacific coast.

Illustrations. A Schmidt, Atlas, pl 30, f. 11–13.

4 **Auliscus punctatus** Bailey, Smith. Contr., 71 5 1853.

Valves elliptical. Surface punctate, the puncta or apiculi connected by delicate lines radiating from the round central space, more evident on a transverse area and absent or less evident near the processes Processes two, large, with an irregular border Variations occur in which the puncta are more evenly distributed and the transverse area is less evident Diam 70–125 μ

Type locality Coast of Florida

Distribution Marine Atlantic Coast

Illustrations Bailey, Smith, Contr, 7 pl f 9, A Schmidt, Atlas, pl 108, f 10, Boyer, Diat Philadelphia, *pl* 5, f 6 See also English Mechanic, vol 106, 7 1917

5 **Auliscus hyalinus** Boyer Bull Torr Club 47 67 1920

Valves subcircular, plane, slightly irregular Central space appearing hyaline, about one-third the diameter of the valve, indistinctly granular or pruinose toward the border, where finely punctate, subtle, radiating striae are interspersed at irregular intervals with delicate, costate lines Processes three, with hyaline border, placed at irregular intervals at a distance from the border greater than their diameter, indistinctly granular The granulation of the surface is somewhat similar to that of *A pulvinatus* Grun or *A le tourneurii* Brun (occurring fossil at Atlantic City and Weymouth, N J), except at the border Diam 86 μ

Type locality Savin Rock, Conn

Distribution Marine Known only from the type locality

Illustrations Bull Torr Club, 47 pl 2, f 4

6 **Auliscus normanianus** Grev Trans Micr Soc Lond 12 82 1864

Valves circular Central space circular, hyaline Striae radiate, converging near the processes, delicate, sometimes pruinose Near the margin, between the processes, numerous apiculi Processes three, large, 15–30 μ in diameter, usually close to the border, their margins striated Diam 70–130 μ

Type locality Moron, Spain (fossil)

Distribution Ashley River, Charleston, So Carolina (Coll H C Wheeler)

Illustrations Trans Micr Soc Lond, 12 pl 11, f 11; A Schmidt, Atlas, pl 32, f. 3, pl 67, f 5, pl 117, f 8, Pant, Foss Bac Ungarns, 1 pl 30, f 314

7 **Auliscus pruinosus** Bailey, Smith Contr 7 5 1853

Valves circular or elliptical, bevelled at the edges in large specimens Central space orbicular Markings interrupted or continuous, curved and irregular punctate lines radiating toward the margin between the processes and converging around them, with numerous hyaline interspaces, more especially toward the border at which the striae are closer Processes two, occasionally three, large, coarsely granular at their margins, usually nearer the border than the centre, except in very large specimens Diam. 99 μ

Type locality Atlantic coast

Distribution Marine Atlantic and Pacific Coasts

Illustrations Bailey, Smith Contr, 7 pl, f 5-8, A Schmidt, Atlas, pl 31, f 6, Boyer, Diat Philadelphia, pl. 5, f 8

The illustration last mentioned is that, apparently, of a variation in which apiculi are present and the processes are surrounded by a wide, hyaline band The granules in the central space are also found in typical forms from Pensacola, Fla

Auliscus moronensis Grev (Trans Micr Soc Lond, 12 83 pl 11, f 6 1864) is reported by Rattray as occurring at Pensacola, Fla This has been considered as not differing from *A pruinosus* (English Mechanic, vol 106, 7 1917)

8 **Auliscus confluens** Grun A Schmidt Atlas pl 32 1875

Valves circular Central space rounded Markings distinct, sometimes confluent, puncta in lines which divide and radiate toward the border on the median areas and converge closely around three sides of each process Hyaline interspaces broad Border finely striated Processes two, sometimes one or three circular, with wide margins Diam 45-115 μ

Type locality Campeche Bay

Distribution Marine Known in N A only from the type locality, although it occurs at Bahia, Brazil

Illustrations A Schmidt, Atlas, pl 32, f 6-8

9 **Auliscus caelatus** Bailey Smith Contr 7 6 1853

Valves elliptical or subcircular Central space round or irregular Median areas more or less distinctly defined near the border Markings delicate striae radiating from the central space on the median areas and developing into costae at the border, converging toward the processes Processes two, large, near the border and usually with crenulate margins Diam 40-150 μ

Type locality Gulf of Mexico

Distribution Marine Atlantic and Pacific Coasts

Illustrations Bailey, Smith Contr, 7 pl f 3, A Schmidt, Atlas, pl 32, f 14, 15, Boyer, Diat Philadelphia, pl 5, f 4

Auliscus caelatus latecostatus A Schmidt, Atlas, pl 32, f 16-20 Markings costate, not radiating, except at the border, the costae sharply defined, with wide, hyaline interspaces Median areas narrow or indistinct Diam 37 μ Campeche Bay

The variations of the type form are quite confusing, passing to *A. sculptus.*

10 **Auliscus sculptus (W Smith) Ralfs, Pritchard, Infusoria, 845. 1861**

Eupodiscus sculptus W Smith, Syn Brit Diat, I 25 1853

Valves subcircular Central space not distinct. Markings coarse and widely separated costae radiating at the border and converging in distinct lines toward the processes Median areas usually well defined. Processes two Diam 60–80 µ.

Type locality England

Distribution Marine. Atlantic Coast

Illustrations W. Smith, Syn. Brit. Diat, I pl 4, f 39, Pritchard, Infusoria, pl. 6, f. 3, Van Heurck, Syn Diat Belg, pl 117, f. 1, 2, Boyer, Diat Philadelphia, pl 5, f 5

On account of the variations of both *A. caelatus* and *A sculptus* it may be well to refer the distinction to the difference in the central space, *A. sculptus*, as Ralfs remarks, having no umbilicus The median areas in both species are quite variable

Auliscus americanus Ehrenb, Mikrogeol, pl 33, 14, f 2, 18, according to Ralfs, probably a form of *A sculptus* in which the "markings were more than usually inconspicuous"

11 **Auliscus floridanus Boyer Bull Torr Club 47: 67 1920**

Valves subtriangular Central space not evident Surface of the valve plane, indistinctly pruinose for two-thirds of the radius and abruptly costate near the border, with sharply defined, coarse costae at irregular intervals, parallel between the processes but converging near them Processes three, close to the border, irregular or triangular, with hyaline margin Diam 70 µ

Type locality Mosquito Inlet, Florida

Distribution Marine. Known only from the type locality

Illustrations Bull Torr Club, 47· pl. 2, f. 3

12 **Auliscus macraeanus Grev, Trans. Micr Soc. Lond II 51 1863**

Valves circular. Central space circular. Median areas indistinct. Markings very fine striae radiating in the median areas and converging toward the processes. Apiculi are present scattered over the surface, closer at the ends of the median areas and forming a row near the border. Processes two, large Diam 70 µ. Closely resembles *A. punctatus* Bailey, except in the arrangement of the apiculi.

Type locality. Ceylon.

Distribution: Marine Coast of S. Carolina. West Indies

Illustrations· A Schmidt, Atlas, pl. 31, f. 5.

13. **Auliscus reticulatus Grev, Trans. Micr Soc Lond, II 46. 1863**

Valves subcircular. Central space large, rounded. Central part of surface distinctly divided into four lobes defined by the ends of the median area and the processes, covered with a reticulation of distinct costae. The border composed of coarse, irregular and distinct costae. Processes two, small. Diam 60–70 µ.

Type locality Cape of Good Hope.

Distribution· Marine California coast

Illustrations Grev Trans Micr Soc Lond 11 pl 2, f 10, A. Schmidt, Atlas, pl 30, f 4.

Auliscus reticulatus quadrisignatus A Schmidt, Atlas, pl 30, f. 5 Differs from the type in having the reticulations more evident on the central part of each of the four lobular divisions Campeche Bay

14 **Auliscus speciosus** A. Schmidt Atlas pl 80 1882

Valves subcircular or obtusely quadrangular Central space circular. Markings interrupted, punctate striae in lines converging to the processes and radiating from the centre and dividing, separated by broad, hyaline interspaces, anastomosing in a reticulum at the sharply defined border Surface elevated at the four elliptical processes which rise abruptly at their outer edges Diam. 150 µ.

Type locality Santa Monica, Cal deposit

Distribution Marine Gulf of Lower California Rare

Illustrations A Schmidt, Atlas, pl 80, f 5, pl. 108, f 3

15 **Auliscus schmidtii** Gruendler A Schmidt Atlas pl 30 1875

Valves elliptical Central space rounded Surface divided into lobes Markings on the lobed portion irregular striae forming a reticulum, most distinct outwards Striae between the lobes and the border straight, distinct, at irregular intervals Processes two, small, distant from the border (Rattray, in part).

Type locality Sumatra.

Distribution. Marine Campeche Bay

Illustrations A Schmidt, Atlas, pl 30, f 7

16 **Auliscus rhipis** A. Schmidt, Atlas, pl. 32 1875

Valves orbicular. Central space hyaline Transverse area, limited by curved lines near the border, expanding fan-like on each side and traversed by anastomosing costae which, outside of the area, converge toward the processes or radiate to the circumference Processes two, large, near the border Diam 70 µ.

Type locality Japan

Distribution Marine. Port Townsend, Wash Common

Illustrations A. Schmidt, Atlas, pl. 32, f. 10, 11.

22 **PSEUDAULISCUS** Leud.-Fort. Mém Soc d Émul Cotes-du-Nord, 64. 1879. Em. Rattray, Jour Roy Micr Soc. 8: 900. 1888.

Valves circular, subcircular or elliptical. Central space absent or scarcely evident. Surface plane or divided into two zones of elevation Markings granular or areolated, in usually radial rows, interspersed, occasionally, with fine striae and apiculi sometimes prominent only on the border Processes usually two, sometimes more, close to the border

Type species, *Pseudauliscus debyi* Leud.-Fort

Valves circular or nearly so Markings granular, in irregular lines or scattered at centre, radiating to border Processes two	1 *P radiatus*
Valves circular or elliptical Markings polygonal, radiating in straight, fasciculate rows Processes 2–4	2 *P peruvianus*

1 **Pseudauliscus radiatus** (Bail) Rattray Jour Roy Micr Soc 8 902 1888
Auliscus radiatus Bail Smith Contr 7 6 1853

Valves circular or nearly so, plane Central area with granules in irregular lines and scattered, radiating toward the border where they are larger Border coarsely striated Processes two, circular, close to the border A small apiculus is inserted at about one-fifth the radius from the border, equally distant on each side from the processes Diam 50 μ

Type locality New York Harbor

Distribution Marine Rockaway Beach, N Y Brigantine, N J Delaware River Pensacola Vera Cruz

Illustrations Smith Contr 7 pl f 13; A Schmidt, Atlas, pl 32, f 28, pl 204, f 20, Boyer, Diat Phila pl 5, f 9

2 **Pseudauliscus peruvianus** (Kitton) Rattray Jour Roy Micr Soc 8 902 1888
Eupodiscus ? peruvianus Kitton, Pritchard, Infusoria 938 1861
Auliscus peruvianus (Kitton) Grev Trans Micr Soc Lond 10 25 1862

Valves circular or elliptical Surface slightly convex Markings polygonal, 6–8 in 10 μ, somewhat concentric in an irregular or elliptical central area, radiating in straight, fasciculate rows, usually 10–12, parallel to the central rows except that near the processes the outer rows of a fasciculus converge Processes two, sometimes three or four, 7–8 μ in diameter, irregular or elliptical, close to the border A small apiculus is frequently found on one side of each process Border with fine striae about 12 in 10 μ, with sometimes a row of small apiculi on the inner edge The markings resemble those of *Coscinodiscus subtilis* Diam 56–90 μ

Type locality Peruvian guano

Distribution San Pedro, Cal. Vera Cruz Colon

Illustrations Trans Micr Soc Lond 10 pl 2, f 6, A. Schmidt, Atlas, pl 32, f 29

In a form from Vera Cruz the markings are more decliate than in the type and the row of apiculi at the border is absent. It is not, however, var *tenera* Rattray

23. RATTRAYELLA De-Toni, Notarisia, 4 691 1889.

Valves circular. Markings minute puncta in radiating lines. Ocelli small, rounded or elliptical Apiculi sometimes present between the ocelli

Type species, *Rattrayella oamaruensis* (Grun.) De-Toni

1 Rattrayella recens Boyer, Contr Biol & Micr Sect Phila Acad 1 8 1922

Valves slightly convex. Markings minute granules scattered or forming an indistinct network in the centre and thence radiating as fine puncta or minute hexagonal reticulations in sinuous lines, with shorter interfasciculate rows, subequal to the border, 15–18 in 10 µ Close to the border, at unequal intervals, numerous (16) distinct, rounded ocelli Apiculi not evident Diam 75 µ.

Differs from *Rattrayella oamaruensis* (Grun) De-Toni, Syll. Alg. 2· 1080 (*Glyphodiscus? simbirskianus* Grun , A Schmidt, Atlas, pl. 125, f 19) in the rounded form and small size of the ocelli. But one specimen noticed, but, as it shows no corrosion apparent in specimens from Ananino, Simbirsk, and Oamaru, and is evidently of recent origin, it is proposed as specifically distinct

Type locality Mobile, Alabama.

Distribution Marine. Known only from the type locality (in slide from Peticolas)

Illustrations Contr Biol & Micr. Sect Phila Acad 1 pl 4, f 6

II RHIZOSOLENATAE

The Rhizosolenatae include a subgroup, Rhizosolenieae, represented by plankton species quite distinct from the Coscinodiscatae. They are chiefly remarkable for the length of the frustule, the connective zone of which is composed of numerous annuli or imbricated scales.

Rhizosolenieae. Characters of the group

Rhizosolenia. Frustules often in filaments, cylindrical or nearly so. Annuli narrow and transverse or in more or less imbricated scales. Valves asymmetrical, terminated by a calyptra.

Dactyliosolen. Frustules in filaments, cylindrical, with imbricated connective zone Annuli narrow, transverse. Valves without calyptrae.

Lauderia. Frustules composed of numerous annuli and united by short, marginal spines.

24. RHIZOSOLENIA Ehrenb., Abh. Akad. Berlin. 1841: 402 1841 Em Brightw., Quart. Jour. Micr Sci. 6: 94 1858.

Frustules frequently concatenate, usually found free, cylindrical or subcylindrical, elongated, composed of numerous annuli or of imbricated laminae or scales Valves asymmetrical, usually calyptriform, and terminated by a mucron or spine Chromatophores small, spherical granules, rounded or sometimes irregular, lying along the cell wall For a discussion of the cell contents see Bergon, Soc Sci Arcachon Trav Lab 6 43 1902. Statospores formerly known under the generic of *Pyxilla* occur as endocytes, *Pyxilla baltica* being the endocyte of *R setigera* Brightw Other forms of *Pyxilla* cannot be associated definitely with particular species of *Rhizosolenia* See Cleve, Ann Rep Fish. Board Scotl. 15 301. pl. f, 12. 1897

Type species, *Rhizosolenia calyptra* Ehrenb. ?

Frustules flattened, annulate, the annuli meeting alternately in zigzag lines	1. *R eriensis*
Frustules slender. Annuli obsolete, apparently smooth	2 *R. gracilis*
Frustules circular or elliptical in section Annuli narrow, with straight lines of imbrication	3. *R. robusta*
Frustules cylindrical Annuli in rhombic scales meeting in pairs in oblique lines Calyptra elongated, with two small scales at the base.	4. *R styliformis*
Frustules cylindrical Annuli in rhombic scales meeting in pairs in oblique lines Calyptra short	5. *R shrubsolei*
Frustules cylindrical, much elongated. Annuli in rhombic scales meeting in oblique lines but scarcely visible Calyptra elongated, with a long seta curved at the end	6 *R setigera*
Frustules cylindrical, elongated, robust Annuli in rhombic scales meeting in frequently irregular, oblique lines Calyptra elongated, without pit, with coarse markings	7. *R. hebetata*
Frustules cylindrical, slender. Annuli in rhombic scales with oblique lines of imbrication. Calyptra twisted, without a mucron, with a fissure at the end	8. *R. alata*

1. **Rhizosolenia eriensis** H L. Smith, Lens, 1: 44. 1872

Frustules flattened, six to twelve times as long as broad, annulate, the annuli alternately meeting in a zigzag line extending along the middle of the frustule. Annuli subtly punctate, the puncta in transverse and longitudinal lines. Calyptra excentric, appearing on the opposite or on the same side of the frustule according to the position of the latter, prolonged into a seta about two-thirds the length of the frustule. Diam. 8–10 µ Length without setae usually about 50 µ, but sometimes much longer. A hyaline connective zone appears in the larger forms. Frustules frequently concatenate.

Type locality Lake Erie, at Cleveland

Distribution Lake Michigan. Chicago water supply

Illustrations Amer. Quart. Micr Jour, 1 pl. 3, f. 7 1878; Van Heurck, Syn. Diat Belg., pl. 79, f 9, Perag., Le Diatomiste, 1. pl. 13, f. 19, H L Smith, T S 447

2 **Rhizosolenia gracilis** H L. Smith Proc Amer Soc Micr, 4 177 1882

Frustules slender. Annuli obsolete, apparently smooth Calyptra conical, symmetrical, elongated Setae as long as or longer than the frustule, sometimes bent or curved, 100 μ in length or more. Diam 4–5 μ (H. L Smith, in part)

Differs from *R. eriensis*, with which it is associated, not only in the apparent absence of markings but in the fact that it is about half as wide and twice as long

Type locality. Buffalo, N Y.

Distribution Fresh water Known only from the type locality

Illustrations H L Smith, Proc Amer Soc Micr, 4 pl 4, f 1 b, b′, H L. Smith, T S 447

3 **Rhizosolenia robusta** Norman Pritchard Infusoria, 866. 1861

Frustules circular or elliptical, in transverse section, very large, up to 160 μ in breadth Annuli narrow, with straight lines of imbrication, subtly punctate in transverse and longitudinal lines. Calyptra asymmetrically conical and curved at the end Seta slender, short, about 25 μ in length

Type locality North Sea

Distribution Pelagic Found in fragments only in northern latitudes Pacific coast

Illustrations Pritchard, Infusoria, pl 8, f 42, Perag, Le Diatomiste, 1 pl 14, f 1; pl 15, f 1, 2, Van Heurck, Treat Diat., pl. 33, f 883, Perag Diat Mar Fr, pl. 123, f 1, 2

4 **Rhizosolenia styliformis** Brightw, Quart Jour Micr Sci. 6 94 1858

Frustules cylindrical, averaging 60 μ in diam Annuli in the form of rhombic scales meeting in pairs in oblique lines of imbrication which appear in one view as a spiral line, in another view with hexagonal outlines alternating with the two triangular ends of the opposing scale. Calyptra elongated, with a short, stout, straight seta or mucron having a small scale on each side at its base. Striae in longitudinal and oblique decussating lines of puncta about 25 in 10 μ

Type locality· England.

Distribution· Pelagic. Vancouver, B. C. Bay of Fundy. Prince Edward Island (L. W. Bailey). West Indies. Coast of Barbadoes.

Illustrations Quart Jour. Micr Sci., 6· pl. 5, f. 5, a-e; Perag., Le Diatomiste, 1 pl. 17, f. 1–5, Perag, Diat. Mar Fr, pl 124, A, f. 1, 2, (spores); H L. Smith, T. S 452.

5 **Rhizosolenia shrubsolei** Cleve, Sv Vet.-Akad Handl (2) 18^5 26 1881

Frustules cylindrical Annuli in the form of rhomboidal scales meeting in pairs with oblique lines of imbrication. Striae punctate, coarse, parallel to the lines of imbrication and, therefore, nearly at right angles to those of adjacent annuli. Calyptra short, eccentric, ending in a robust mucron with a fine short seta. The pit or depression of the calyptra prominent Diam 20 µ Considered by Peragallo as a slender form of *R imbricata* Brightw

Type locality· Coast of England

Distribution Pelagic North Atlantic Ocean

Illustrations Van Heurck, Syn Diat. Belg, pl. 79, f. 11–13; Perag Le Diatomiste, 1 pl 18, f. 8, 9, Perag, Diat. Mar. Fr., pl 124, A, f. 5

6 **Rhizosolenia setigera** Brightw, Quart. Jour Micr Sci. 6: 95. 1858

Frustules cylindrical or nearly so, much elongated. Annuli in the form of rhomboidal scales meeting in pairs in oblique lines of imbrication, similar to those of *R styliformis* but scarcely visible. Striae delicate, in oblique decussating rows Calyptra elongated, with a long seta usually curved near the end Diam. 15–30 µ According to Peragallo frequently found in large masses made up of closely packed bundles The statospores are known as *Pyxilla baltica*.

Type locality. England

Distribution Pelagic Bay of Fundy Vancouver, B C (L W. Bailey) Long Island Sound (frequent in the form of statospores).

Illustrations. Brightw, Quart. Jour. Micr. Sci. 6. pl. 5, f. 7; Pritchard, Infusoria, pl. 7, f. 33; Van Heurck, Syn Diat. Belg., pl. 78, f 6–8 ?, Perag., Le Diatomiste, 1. pl 17, f. 12–16, Perag. Diat. Mar Fr., pl. 124, f. 11–15, L. W Bailey, Contr. Can. Biol., pl. 2, f. 1. 1915; H. L. Smith, T. S. 450.

7. **Rhizosolenia hebetata** Bailey, Amer Jour Sci., 22: 5. 1856.

Frustule cylindrical, elongated, robust Annuli in the form of rhomboidal scales meeting in broad lines of imbrication, frequently irregular. Striae in oblique decussating lines 25 in 10 µ. Calyptra elongated, without pit or depression, robust, with coarse markings in longitudinal or irregular, interrupted lines. Mucron short, obtuse, with a hollow centre. Diam. 20–30 µ.

Type locality. Kamtschatka.

Distribution. Pelagic. Arctic and North Pacific Oceans.

Illustrations Bailey, Amer Jour Sci, 22 pl 1, f 18; Cleve, Vega-Exp Iaktt 3: pl. 38, f 69, Grun, Denks. Akad. Wien 48· pl. 5, f 48, Perag, Le Diatomiste, 1 pl 18, f. 10; H L Smith, T S. 448.

8 **Rhizosolenia alata** Brightw Quart. Jour Micr Sci 6 95 1858

Frustules cylindrical, slender, much elongated Annuli in the form of rhomboidal scales with oblique lines of imbrication. Striae subtle. Calyptra elongated, twisted, without a mucron, with a minute fissure at the end At the base of the calyptra is a short spine which enters the fissure at the end of the opposing calyptra when the frustules are attached Diam 5–8 μ.

Type locality North Atlantic

Distribution Pelagic Known in North America from the type locality only

Illustrations Brightw, Quart Jour Micr. Sci 6 pl. 5, f. 8; Van Heurck, Syn Diat Belg., pl 79, f 8, Perag, Le Diatomiste, 1. pl. 18, f 11, Perag, Diat Mar. Fr, pl. 124, f 7.

The calyptra in this species, as Peragallo describes it, is peculiar. The simplest form of calyptra, as in *R hebetata*, is merely a cone with a mucron at the end. In most forms, however, when the calyptra is eccentric, the flattened side of the cone is hollowed out into a groove in such a manner as to allow the mucron of the opposing frustule to rest in it. Now, in *R alata*, there is no hollow space and no mucron of the ordinary type, but the sheath enclosing the groove is extended as though it were a mucron, while the hollow space or groove is represented by the minute fissure at the end The spine which, ordinarily, is at the end of the calyptra remains at the base of the prolonged sheath. In other words the mucron and the sheath have exchanged places, but the spine which represented originally a mucron is still embedded in the fissure at the end of the prolonged sheath when the frustules cohere.

Species Excluded

Rhizosolenia americana Ehrenb, is ***Pyxilla americana*** Grun, a spore of ***Rhizosolenia.***

Rhizosolenia barbata Ehreb., is ***Goniothecium barbatum***, a spore of ***Chaetoceros.***

Pyxilla ? variabilis Grun., in Van Heurck, Syn. Diat. Belg. pl. 83, f. 3, 4, occurs in the Arctic Ocean. It appears to be the same as ***Isthmia? vitrea*** Kitton, Mo. Micr Jour. 10. 206. pl. 38, f. 3. 1873, and is, probably, a spore form of ***Rhizosolenia.***

Pyxilla ? baltica Grun, is a spore of ***Rhizosolenia setigera*** Brightw This is not *Pyxilla baltica* Hensen (in Schütt, Das Pflanzenleben der Hochsee, 21 · f 10 1893) which is not reported from North America

25 DACTYLIOSOLEN Castr, Rep. Voy Chall Bot 2 75 1886.

Frustules in filaments, cylindrical, much elongated, imbricate, the zones of imbrication meeting at oblique angles, in their successive union forming a spiral. Annuli each half the circumference, areolate, the areolae quadrate At intervals in the filaments, hyaline bands, not imbricated, occur, four or five times the width of the annuli, evidently the connective between two frustules. Valves apparently plane and circular but not defined owing to the difficulty of observation

Type species, *Dactyliosolen antarcticus* Castr.

1 **Dactyliosolen antarcticus Castr, Rep. Voy Chall. Bot. 2 75 1886.**

Frustules robust. Characters of the genus Diam. 20–60 µ.

Type locality. Antarctic Sea

Distribution Pelagic North Atlantic. Rare.

Illustrations Castr, Rep Voy. Chall. Bot 2 · pl. 9, f. 7, Peragallo, in Le Diatomiste 1 · pl 13, f. 7.

This form is not yet reported from the North American coast but it occurs in slides mounted by Klavsen marked "North Atlantic" As is the case with other Arctic and northern pelagic species its occurrence on our coasts is probable

26. LAUDERIA Cleve, Bih. Sv Vet.-Akad. Handl 1^{11} 8. 1873.

Frustules sometimes membranaceous, cylindrical, composed of numerous annuli, minutely punctate Valves circular, with short, thread-like marginal spines which unite with those of the opposite frustule.

Type species, *Lauderia annulata* Cleve.

1 ***Lauderia confervacea*, Cleve, Bih Sv Vet -Akad Handl 22(3)^4: 11 1896**

Frustules united in long threads, membranacecus Spines at the margin of the valve very short, 10 in 10 µ. Diam. of frustule 10 µ.

Type locality. Baffin Bay.

Distribution · Known only from the type locality.

Illustrations · Cleve, Bih. Sv. Vet -Akad. Handl, 22 (3)^4: pl. 2, f. 21.

III. BIDDULPHIATAE

The Biddulphiatae are divided into three subgroups.

Chaetocereae. Valves circular or elliptical, with horns or setae much longer than the frustule. Chiefly plankton or pelagic forms.

Biddulphieae Valves orbicular, elliptical, triangular or polygonal Horns represented by spines or elevations of the angles, sometimes absent.

Anauleae Valves elliptical or lunate, with transverse septa. Horns short or absent

The Biddulphoid forms as here arranged appear to be heterogeneous. They are readily distinguished from the Rhizosolenatae by the absence of numerous girdle bands or imbricated annuli. They differ from the Coscinodiscatae in the development of the girdle or connective zone and in the presence of spines, setae or horns on the margins of the valves or, in elliptical or angular species, in elevations of one or more angles

The proper arrangement of genera is difficult, while the distinctions between them are so obscure that, in many cases, the synonymy is much confused It appears to be advisable to classify species into genera in accordance with the successive appearance or gradual loss of various appendages or markings which occur from a change of habitat. The plankton or pelagic diatoms require some method of flotation which is supplied, in the Chaetocereae, by numerous, long, thread-like horns or setae which unite the frustules into extended filaments In paralian forms which are often attached to rocks, shells or sea weed, the apparatus required for flotation disappears or is reduced to a method of uniting the frustules less securely

5 Chaetocereae

1 *Chaetoceros.* Frustules in long filaments, separated by foramina and united by setae Valves usually elliptical

2. *Bacteriastrum.* Frustules in filaments, without foramina. Valves circular Setae at right angles to the filament

3 *Corethron* Frustules free or geminate Valves hemispherical Setae in a crown on the margin.

4 *Attheya* Frustules free, annulate, compressed Valves elliptical, with central punctum and a seta at each end.

Attheya is placed with the Chaetocereae by Peragallo. It has been associated with the Fragilariatae because of the apparent pseudoraphe. On account of the annuli and because the setae somewhat resemble calyptrae it might be included among the Rhizosolenatae. It is probably a survivor of a plankton form and has retained the annuli. Its habit in brackish water and on the shore has evidently caused it to lose the mechanism for flotation. It appears to be proper to consider it as intermediate between the Chaetocereae and the Rhizosolenatae

27 CHAETOCEROS Ehrenb., Ber Akad Berlin 1844: 198. 1844.

Frustules in short or long filaments, sometimes free, oblong, separated by foramina and united by setae crossing each other near their insertion. Valves convex, concave or plane, usually elliptical, sometimes nearly circular. From each valve extend two setae, one on each side, which cross the setae of the opposing valve. Setae robust or slender, variable in length, with or without spines, punctate or transversely striated, often hollow.

Chromatophores of various kinds, either laminate, single, on the wall of the zone, double, one on each valve, or granular and more or less numerous, either on the wall of the cell or scattered through the cell and the setae Pyrenoids occasionally found

Type species, *Chaetoceros tetrachaeta* Ehrenb.

Spores occur in some species with more or less equal and convex valves, sometimes furnished with spines or with the setae of the parent cell attached All species are marine or occur in saline water

Gran classifies the genus according to the chromatophores. Peragallo remarks that, as the variation in number and form of the chromatophores is very great and as they cannot always be determined it is best to rely more upon the structure of the frustule, not omitting, however, a consideration of the cell contents The classification of Peragallo into groups according to the setae is here followed, with a group added

Robusta. Setae robust, spinous, equal or nearly so on the entire filament Frustules robust.	
Frustules cylindrical, elongated Valves concave, with a small spine in the centre. Setae hollow, crossing at right angles.	1. *C. atlanticum*
Frustules cylindrical. Valves convex. Setae very long, hollow, crossing at oblique angles.	2. *C. boreale*
Frustules free or in short filaments, robust. Valves unequal Setae robust, spinous.	3 *C. peruvianum*
Frustules oblong, solitary or in filaments. Valves unequal. Setae very long, slender, hollow, with spines.	4. *C. criophilum*
Frustules usually in twisted filaments. Setae thick, covered with hollow spines.	5. *C. scolopendra*

Affinia. Terminal setae spinous or punctate, robust, the others smooth and slender

Frustules quadrangular, with sharp angles. Valves concave, with a spherical elevation in the centre. Setae long, slender, smooth, crossing at an oblique angle 6 *C didymum*

Frustules in curved filaments, rectangular Valves concave Setae crossing at right angles. Terminal setae more robust than the others. 7 *C. curvisetum*

Genuina Setae punctated and finely striated, distinguished by their different direction

Frustules flattened, usually five or six in a filament

Valves concave Lateral setae crossing the filaments obliquely Terminal setae shorter, curved 8 *C decipiens*

Frustules in straight filaments. Valves concave.

Setae at right angles to filament. Terminal setae thicker 9 *C. teres*

Frustules rectangular. Valves slightly convex. Setae slender, crossing nearly at right angles, two turning in a sagittal direction and two transversely. 10 *C. diadema*

Frustules quadrangular. Setae long, delicate, crossing at an oblique angle and extending at right angles, coarsely punctate 11. *C. mitra.*

Diversa Setae slender, some of the intermediate more robust than the others.

Frustules frequently in twisted filaments Valves slightly convex Setae of two kinds, one slender, the other thicker and flexuose. 12 *C. compressum*

Setosa. Setae alike throughout the filament

Frustules in curved filaments. Valves slightly convex. Setae with puncta in spiral lines, differing in length. Two turn outward on one side; on the other side one unites with that of another filament. 13. *C. sociale*

Frustules in short or long filaments. Lateral setae coalescing at the base with those opposite. 14. *C. furcellatum*

Frustules in straight filaments. Valves concave. Setae slender, one on each side in the sagittal axis, the other in the transverse axis. 15 *C. wighamii*

Frustules in straight or curved filaments. Valves plane Setae slender, diverging, oblique to the filament 16. *C. incurvum*

Frustules single, not in chains. Setae slender. 17. *C. septentrionale*

Conjuncta Frustules united by a tubular commissure.

Frustules in long filaments Valves convex Setae hollow, at an angle of 45 degrees 18. *C elmorei*

1 **Chaetoceros atlanticum** Cleve Cleve & Grun. Sv Vet.-Akad Handl 11 17^{2} 121 1880

Frustules sub-cylindrical, oblong, elongated, with zone well developed Foramina broad, hexagonal Valves concave, elliptical, with a small spine in the centre Markings subtle puncta in longitudinal, transverse and oblique lines Setae crossing each other at right angles and lying almost in the same plane, the terminal slightly thicker, becoming parallel to the filament The setae, hollow and filled with protoplasm and chromatophores, are striated, with four rows of minute spines Diam 15–40 μ.

Type locality North Atlantic

Distribution Pelagic Atlantic Ocean. Davis Strait

Illustrations Cleve, Bih Sv. Vet-Akad Handl. 1^{13} pl. 2, f. 8; Perag, Diat Mar Fr, pl 128, f. 5

2 **Chaetoceros boreale** Bailey Smith Contr, 7: 8 1853.

Frustules subcylindrical, oblong, with lanceolate or hexagonal foramina Valves elliptical, convex Setae very long, robust, hollow, filled with protoplasm and chromatophores, crossing at an oblique angle, spinous, except toward the ends Markings punctate, extremely subtle, in oblique, decussating rows

Type locality St. George's Bank, Atlantic Ocean

Distribution Pelagic Arctic, Atlantic and Pacific Oceans.

Illustrations. Bailey, Smith. Contr., 7 pl. f. 22, 23; Wallich, Trans. Micr. Soc. Lond, 8· pl. 2, f. 18. 1860, Perag., Diat. Mar. Fr, pl. 127, f. 2.

Chaetoceros boreale brightwellii Cleve, Bih. Sv. Vet.-Akad. Handl. 1^{13}· pl. 2, f. 7 Setae with smaller spines thanin the type. Perag., Diat. Mar. Fr., pl. 127, f. 3. Davis Strait.

3 **Chaetoceros peruvianum** Brightw, Quart. Jour. Micr Sci., 4: 107. 1856.

Frustules free or in short filaments, robust, with short, rectangular foramina and well-defined zone. Valves unequal, the upper more convex than the lower. Setae robust, spinous, transversely striated, curving downward, those from the upper valve inserted nearer the middle of the valve than those from the lower Chromatophores numerous, rounded, scattered within the cell and the setae. Spores unknown Diam 30 µ

Type locality. Peruvian Guano

Distribution Pelagic Atlantic and Pacific Oceans

Illustrations Brightw , Quart Jour. Micr Sci 4 pl. 7, f 16–18. 1856, pl 8, f. 9, 10 1858; Perag , Diat. Mar Fr., pl 125, f 1.

4 **Chaetoceros criophilum** Castr Voy Chall Bot. 2 78. 1886

Frustules oblong, solitary or in filaments Valves unequal, the upper larger and more convex than the lower Setae very long, slender, hollow, with spines pointing downward, arising from near the middle of the valves, those from the upper valves reflexed, while those from the lower valves are curved near their insertion and extend downward, sometimes crossing the frustule Chromatophores numerous Nucleus situated on one wall near the centre Diam about 20 µ

Type locality Antarctic Ocean

Distribution Pelagic Arctic and North Atlantic Oceans

Illustrations Castr , Rep. Voy Chall Bot 2 78 f , Perag., Diat Mar Fr pl. 126, f 2, 3

5 **Chaetoceros scolopendra** Cleve, Bih Sv Vet -Akad Handl 22 (3)^{1} 30 1896.

Frustules usually in twisted filaments, rectangular, with truncate angles and linear foramina slightly narrowed in the middle. Setae rather thick, extending at right angles after crossing and then curving, covered with hollow spines which are supposed to secrete mucilage Diam 10 µ Chromatophores single, laminate, on the wall of the zone Spores not identified

Type locality. North Atlantic

Distribution Pelagic Vancouver, B C.

Illustrations Gran, Norw N. Atlantic Exp. 7 Bot Diat pl 4, f. 52, 53.

6. **Chaetoceros didymum** Ehrenb., Ber Akad Berlin, 75 1845

Frustules quadrangular, with sharp angles, broader than long, usually, in mature filaments, with zone well defined. Valves concave, with a hemispherical elevation in the centre. Foramina elliptical, constricted by elevations of the valves Setae long, slender, smooth, crossing at an oblique angle close to the filament and thence extending at right angles but frequently recurved toward the filament. Terminal setae long, slightly broader than the others, curved in the direction of the filament. Spores geminate, smooth, the primary or outer valve conical, the secondary less so. The secondary valve is enclosed by a valve of the mother cell, from which two setae arise and cross in a curve the setae of the opposite mother valve containing the other spore. According to the usual method in other species the primary valve is enclosed. Endochrome in two bands, one on each valve, with a large pyrenoid in the centre within the hemispherical elevation Diam. 15–25 µ.

Type locality Peruvian guano.

Distribution Pelagic Arctic and Atlantic Oceans Vancouver (L W Bailey).

Illustrations Ehrenb, Mikrogeol., pl 35, A, 18, f. 4, Brightw., Quart. Jour Micr. Sci, 4. pl 7, f 3–7. 1856, Gran, Norw. N. Atlantic Exp., 7. Bot. Diat., pl. 1, f 9, 10; Perag., Diat. Mar. Fr. pl. 128, f. 1, 2.

The spores appear to be *Goniothecium gastridium* Ehrenb., equivalent to *Chaetoceros Gastridium* Ehr., Van Heurck, Syn. Diat Belg., pl. 82 bis, f 1, 2; Brightw, Quart Jour. Micr. Sci., 4 pl. 7, f 8 1856.

7 **Chaetoceros curvisetum** Cleve Bih Sv Vet. Akad Handl 20 $(3)^2$ 12. 1894

Frustules in curved filaments, rectangular, with acute angles Foramina circular or nearly so. Valves concave, elliptical; zone broad Setae crossing near their insertion and extending at right angles to the filament and curved toward the same side. Terminal setae more robust than the others, punctate. Chromatophore single, laminate, on the wall of the zone, with a large pyrenoid in the centre. Spore smooth, unequally conical, in the middle of the frustule. Diam 10–16 µ

The above is a description of specimens from the Kattegat and corresponds to Peragello's form Gran describes the species as having spores equally conical.

Type locality North Atlantic.

Distribution Atlantic Ocean, but not yet recorded near the coast.

Illustrations Cleve, Bih Sv Vet.-Akad Handl. 20 $(3)^2$. pl. 1, f. 5; Perag. Diat. Mar. Fr., pl. 129, f 4–6.

8 **Chaetoceros decipiens** Cleve, Bih Sv Vet.-Akad Handl 11 1^{12}: 11 1873.

Frustules flattened, usually 5–6 in a filament, quadrangular, with sharp angles. Foramina elliptical or linear, sometimes slightly constricted in the middle. The lateral setae crossing near the filament in an oblique angle and slightly diverging. Terminal setae shorter, curving and becoming nearly parallel to the filament, subtly transversely striated. Valves concave, elliptical. Diam. 12–78 µ. Chromatophores irregular patches on the walls of the cell. Nucleus on the wall. Spores unknown.

The foramina are narrow in winter and wider in summer, and

Gran describes the winter form as forma *hiemalis* and the summer form as forma *interrupta*.

Type locality. North Atlantic.

Distribution: Pelagic. Davis Strait. Arctic Ocean. Bay of Fundy (L. W. Bailey).

Illustrations: Cleve, Bih., Sv Vet-Akad Handl. 1^{18}, pl 1, f. 5; Gran, Norw. N. Atlantic Exp 7 Bot Diat pl 1, f 2, 3, pl 3, f 34; Perag. Diat. Mar Fr, pl 131, f. 4, 5, 6, 8

9. **Chaetoceros teres** Cleve, Bih. Sv Vet.-Akad. Handl. 22 (3)^{8} 30 1896

Frustules in straight filaments, with sharp angles Foramina narrow, lanceolate or linear Valves concave, often circular or nearly so. Setae arising from the angles and crossing near their insertion, extending at right angles to the filament, punctate Terminal setae thicker, diverging in a broad curve Diam. 42 µ. Chromatophores numerous, rounded or irregular laminae on the walls of the cell Spores with nearly equal valves, hemispherical, smooth.

Type locality: North Atlantic.

Distribution Pelagic. Arctic and Atlantic Oceans.

Illustrations. Bih. Sv Vet-Akad Handl 22 (3)^{8} f. 7, Gran., Norw. N. Atlantic Exp 7. Bot. Diat. pl. 3, f 35, 36, Perag, Diat Mar Fr. pl. 134, f. 1

10. **Chaetoceros diadema** (Ehrenb.) Gran., Norw N Atlantic Exp 7 Bot. Diat, 20 1897
   Syndendrium Diadema Ehrenb. Ber. Akad. Berlin 1845 155 1845 Mikrogeol. pl 35, 18, f 13 The spore form
   Chaetoceros paradoxum Cleve, Bih Sv Vet.-Akad Handl 1. 10 1873
   Chaetoceros Clevei Schütt, Ber. Deuts. Bot Ges. 13 40 1895.
   Chaetoceros groenlandicum Cleve, Bih Sv Vet-Akad Handl 22 (3)^{4} 7. 1896

Frustules rectangular, with oblong, slightly constricted foramina Valves slightly convex, elliptical. Setae slender, crossing nearly at right angles, two turning in a sagittal direction and the other two turning transversely to opposite sides. Terminal setae diverging, slightly thicker in the middle, punctate, the puncta in spiral lines. Chromatophore single, laminate, on the zone. Spores at one end of the mother cell with the secondary valve opposite the nearest valve of the adjacent frustule. Primary valve of spore more convex than the other, with from four to numerous spines branching dichotomously. Diam. 35 µ.

Type locality: Peruvian guano.

Distribution: Pelagic. Arctic, Atlantic and Pacific Oceans. Spores occur in St. George's River, Maine.

Illustrations: Quart. Jour. Micr. Sci 4: pl. 7, f 49–52. 1856, Schütt, Ber. Deuts. Bot. Ges. 13: pl. 4, f. 8 a, Gran, Norw. N. Atlantic Exp. 7: Bot. Diat. pl 2, f 16–18; Perag, Diat. Mar. Fr. pl 132, f 1, 2; Cleve, Bih. Sv Vet-Akad. Handl. 1^{11} pl 3, f. 16.

11 **Chaetoceros mitra (Bail) Cleve, Bih Sv Vet.-Akad Handl. 22 $(3)^4$ 8 1896.**

Dicladia mitra Bail, Amer Jour Sci Ser 2 22 4. 1856
Dicladia groenlandica Cleve, Bih Sv Vet-Akad Handl 1^{11}; 12. 1873

Frustules in long chains, quadrangular. Foramina narrow, elliptical. Valves elliptical, concave Lateral setae slender, at right angles to each other Terminal setae more robust than the lateral, with puncta in spiral lines Diam. 38 μ. Spores with one valve flattened, the other elevated into two cones, each having a branching spine

Type locality Kamtschatka

Distribution Greenland and Baffin Bay.

Illustrations: Bail Amer Jour Sci Ser. 2 22: pl. 1, f. 6, Van Heurck, Syn Diat Belg, pl 106, f 12, 13, Cleve, Bih. Sv Vet.-Akad. Handl. 1^{11} pl 2, f 10, Cleve, Bih. Sv. Vet.-Akad. Handl 22 $(3)^4$ pl 2, f 2.

Dicladia capreolus Ehrenb, Mikrogeol, pl. 18, f. 101, 102, is the spore form of the same species found in the miocene deposits, also illustrated in Van Heurck, Syn Diat. Belg, pl. 106, f. 14–16.

The species resembles *C decipiens* Cleve, the spores of which are undetermined

12 **Chaetoceros contortum Schütt, Ber Deuts Bot. Ges. 13 44. 1895**

Frustules frequently in twisted filaments, rectangular or square, with rectangular foramina slightly constricted in the middle Valves slightly convex. Setae extending from within the angles obliquely and crossing at a distance on a line with the filament, punctate in a spiral line, of two kinds, one slender, the other thicker, flexuose and curving downward. Diam. 16 μ. Chromatophores rounded granules, usually from 10–15, on the walls of the cell Spores smooth, the valves nearly equally convex.

Type locality Baltic Sea.

Distribution Arctic and North Atlantic Oceans.

Illustrations: Schütt, Botan Zeitung 46: pl. 3, f. 4 (1888); Gran, Norw N Atlantic Exp. 7. Bot Diat pl. 2, f. 32.

13 **Chaetoceros sociale Lauder, Trans. Mic. Soc. Lond. 12: 77 1864.**

Frustules in curved filaments, rectangular, with rounded angles and somewhat rectangular foramina. Valves slightly convex. Setae, with puncta in spiral lines, differing in length. Two on one side diverge at an acute angle and extend outwards in the sagittal line. On the other side one seta is curved downward or across the frustule, the other, much longer, is extended in the sagittal line uniting with others from the same and other filaments into a thread-like mass which connects the filaments into a colony surrounded by mucus Diam. 5–6 µ, sometimes larger. Chromatophores single, laminate, on the wall of the zone Spores smooth, with valves nearly equally convex

Type locality. Hong Kong.

Distribution · Arctic and North Atlantic Oceans.

Illustrations Lauder, Trans Mic Soc. Lond., 12 pl 8, f. 1; Gran, Norw. N. Atlantic Exp 7 Bot Diat. pl 4, f. 54; Perag. Diat. Mar Fr pl. 132, f. 1–3

14. **Chaetoceros furcellatum Bail**, Amer Jour Sci Ser 2 22 3 1856.

Frustules in short or long chains, quadrangular, with sharp angles Foramina narrow Valves elliptical, slightly concave Terminal and lateral setae alike, slender, the lateral coalescing at the base with setae of the opposite frustule and extending at right angles to the frustule or nearly so Spores more or less conical at both ends, in zone view, elliptical in valve view, with two setae of the parent cell coalescing at the base extending on each side at right angles and parallel to each other or slightly divergent Diam. 8–20 µ

Type locality Sea of Okotsk

Distribution Davis Strait Baffins Bay Arctic Ocean

Illustrations Bail, Amer. Jour Sci Ser 2 22 pl 1, f 4, Cleve, Bih. Sv Vet -Akad. Handl 22 (3)^4 pl 2, f 6, Gran, Norw. N Atlantic Exp 7 Bot. Diat pl 4, f 48, 49.

15 **Chaetoceros wighamii Brightw** Quart Jour Micr Sci 4 108 1856

Frustules in straight filaments, rectangular, with sharp angles Foramina lanceolate, sometimes slightly constricted in the middle Valves elliptical, concave Setae slender, arising from the angles and crossing obliquely at a distance from the filament, in valve view extending, one on each side, in the direction of the sagittal axis, and the other usually at right angles, in the direction of the transverse axis, to the opposite side Terminal setae similar to the others. Diam. 5–25 µ Chromatophores single, laminate, on the wall of the zone, with a large pyrenoid in the centre Spores with unequal valves, the primary valve convex and spinous, the secondary in the form of the frustum of a cone

Type locality: England

Distribution: North Atlantic Ocean.

Illustrations: Quart. Jour. Micr Sci. 4 pl 7, f. 19–36, Ralfs, in Pritchard, Infusoria, pl 6, f. 24, Perag Diat. Mar. Fr., pl 133, f. 6; pl. 134, f. 4, H. L. Smith, T S 68

16. **Chaetoceros incurvum Bail.**, Smith. Contr., 7: 9. 1853

Chaetoceros cinctum Gran , Norw N. Atlantic Exp 7 Bot. Diat 24 1897

Frustules in straight or curved filaments, rectangular, rounded at the angles. Foramina narrow Valves plane, elliptical. Setae slender, extending obliquely to the filament and diverging to opposite sides. When spores are formed the alternate foramina disappear, the valves of adjacent frustules are close together and the spores at the ends of the frustules coalesce in pairs with the cell walls while the setae of the parent cell become thicker, coalesce and extend outward in the sagittal plane and then separate and are reflexed on each side, thus forming a ring around the spore. Primary valves somewhat conical, with short spines; secondary valves plane. Diam 6–10 μ. Chromatophore single, along the wall of the zone.

There is a difference in the amount of coalescence of the spores and the setae which accounts for the variations in the figures. In spores from the Miocene of Sendai, Japan, there is less coalescence than in some recent forms

Type locality Miocene of Richmond, Va.

Distribution Atlantic Ocean

Illustrations. Bail, Smith Contr (1853) 7. pl, f 31, 32, Brightw. Quart. Jour. Micr Sci. 4 pl. 7, f 9–11, Gran. Norw. N. Atlantic Exp. 7. Bot Diat. pl 2, f 23–27; Perag Diat. Mar Fr, pl 126, f. 7, 8.

17 **Chaetoceros septentrionale Oestrup Meddelelser om Groenland, 18 457 1895**

Frustules single, not in chains, quadrate Valves elliptical, concave, the angles extended into slender setae. Diam. 6–8 μ. Spores elliptical, with one seta of the parent valve extending on each side.

Type locality· Davis Strait.

Distribution Plankton of Baffins Bay. (Cleve.)

Illustrations Oestrup, Meddelelser om Groenland, 18: pl 7, f 88; Cleve, Bih. Sv Vet-Akad. Handl 22 $(3)^4$: pl. 2, f. 8.

18. **Chaetoceros elmorei Boyer, Proc. Acad Phila., 66 219. 1914.**

Chaetoceros quellense L W Bail, Contr Can Biol., 159 1922

Frustules in long straight filaments usually consisting of twenty or more cells, rectangular, with sharp angles and narrow, linear, irregular, bipartite foramina. Valves elliptical, somewhat convex. Frustules united by a tube or comissure, 6 to .8 μ in thickness, situated near the side of the valve, usually at equal distances from each end and on the same side of all valves in the filament Setae hollow, subtly punctate, extending at an angle of about 45 degrees from the filament and crossing at right angles, diverging in valve view at an angle of about 80 degrees, very long, twenty or more times the length of the frustule. Terminal setae similar to the others, but shorter, extending obliquely and somewhat curved toward the filament. Chromatophores placcochromatic. Spores with primary valve arcuate, the secondary valve produced into a subconical frustum Free spores frequently show the primary valve covered with minute spines. Diam 10–23 µ.

After many examinations of the material from Little Quill Lake, Saskatchewan, I am unable to distinguish the forms of *Chaetoceros* from the species found in Devil's Lake, North Dakota, although the Little Quill Lake material contains more of the immature and shorter filaments, the result of colder habitat

Type locality Devil's Lake, North Dakota

Distribution Slightly brackish water Little Quill Lake, Saskatchewan, Canada

Illustrations Boyer, Proc Acad Phila 66· pl 10, f 1–7, L. W. Bail., Contr Can. Biol. pl. 1, f. 2 1922

Genera and Species Excluded

The genus *Goniothecium* Ehrenb , is composed, in part, of spores of *Chaetoceros* and, in part, of those of *Rhizosolenia*

Dicladia Ehrenb , and *Periptera* Ehrenb., are obsolete genera founded on spores of *Chaetoceros* occurring chiefly in miocene deposits.

Chaetoceros coarctatum Laud , Trans Micr Soc Lond 12 79. pl. 8, f. 8 1864 This species is described by Lauder as occurring in the Harbor of Hong Kong and by Cleve as found in the Sea of Java. Mann (Contr U. S. Nat Herb 10⁵ 287 1907) reports its occurrence in Bering Sea at a depth of 913 fms and also (Proc U S Nat Mus. 16 305 1893) as found in dredgings in the Atlantic Ocean off Delaware Bay. As the specimens when found were probably dead valves the species, without further knowledge, cannot be considered among recent forms of N America

It has not been possible to obtain many specimens of *Chaetoceros* from near the shores of the North American continent and descriptions of some of the species have been based upon a large collection of mounted slides prepared by P Klavsen, Odense, Denmark, which represent, however, species reported from the Arctic Sea and the North Atlantic.

28. **BACTERIASTRUM** Shadb , Trans Micr Soc. Lond 2 14 1854 Em Lauder, Trans. Micr Soc. Lond 12 6. 1864

Frustules cylindrical, quadrangular in zone view, united closely without foramina into filaments. Valves circular. Setae arising near the margin and curved at right angles to the filament near their insertion, of various kinds. The intermediate setae, variable in number, frequently coalesce, two from opposite valves uniting into a single straight or curved slender awn which sometimes bifurcates toward the end The terminal setae thicker, in a single row, crowning each end and either straight or curved, usually spirally punctate, the puncta more evident than in the intermediate setae Distinguished from *Chaetoceros* by the cylindrical filament without foramina and by the circular arrangement of the numerous setae.

Type species, *Bacteriastrum furcatum* Shadb.

1 **Bacteriastrum furcatum Shadb., Trans. Micr Soc. Lond. 2 14 1854.**

Bacteriastrum varians Lauder, Trans. Micr Soc. Lond. 12 8 1864

Filaments composed of numerous frustules, usually about twenty Setae of various kinds, straight or curved, the terminal spirally punctate, coarser than the intermediate, varying in number up to thirty. The intermediate setae frequently coalesce into straight or bifurcate awns Spores with unequally convex valves, one of which is furnished with four or five spines Chromatophores numerous, rounded, small, flattened discs.

Type locality Port Natal

Distribution Pelagic Coast of British Columbia. Vera Cruz.

Illustrations Trans Micr Soc Lond 2 pl. 1, f 1, 2; Trans. Micr. Soc. Lond 12 pl. 3, f. 1–6, Pritchard, Infusoria, pl 6, f. 26; Jour. Quek Club, Ser 2, 3· pl 4, f 2. 1887; Perag. Diat. Mar. Fr. pl. 136, f 1–5; H L. Smith, T S 57

29. **CORETHRON Castr, Rep. Voy Chall Bot. 2 85 1886.**

Frustules cylindrical, free, frequently geminate. Valves hemispherical, with a crown of long setae on the margin. In some species the zone is annulate Chromatophores numerous, elongated.

Type species, *Corethron criophilum* Castr

1 **Corethron hystrix Hensen, Ber Kom Untersuch Deuts. Meere Kiel. 89. 1887**

Frustules with minute puncta in longitudinal rows, scarcely visible. Valves minutely punctate Setae smooth, on the margin of the valve, extending upward at an angle of 45 degrees on one valve and reversed at the same angle on the other valve. A number of smaller hairs, club-shaped at the ends, are usually found on one or both valves. While the frustules are more often found free they frequently occur geminate, in which case the setae of the two valves opposite each other are extended parallel to the longitudinal axis and interlace. At the same time the club-shaped hairs lie along the setae. These hairs are flattened at the ends and bent into two curved hooks which embrace the setae, apparently keeping them in position to meet the opposite setae.

The valves of the young frustules are unequal, the smaller valve extending the setae forward in a longitudinal line, embraced by the club-shaped hairs, while the other valve extends the setae outward at an angle of 45 degrees When the frustule grows the valves become equal, the club-shaped hairs fall off and the setae spring back and reverse themselves at an angle of 45 degrees, so that all of the setae of the two valves are parallel

Type locality Atlantic Ocean.

Distribution Plankton. Vancouver, B. C.

Illustrations: Cleve, Ann Rep. Fish Board Scotl. 15. pl. 8, f. 15. 1897; Perag. Diat Mar Fr, pl 137, f 3, 4

This form is near *C criophilum* Castr, of the Antarctic Ocean, but is shorter, less robust and with smaller hooks

30. ATTHEYA T West, Trans. Micr Soc. Lond 8 152 1860

Frustules free, annulate, compressed, in zone view quadrangular. Extending from each angle is a strong spine or seta half as long as the valve Valves elliptical-lanceolate, with a central punctum from which an indistinct line extends to each seta The seta may be considered in the nature of a calyptra while the central punctum and the longitudinal line appear to connect the genus with the Pennatae.

Type species, *Attheya decora* West.

1. Attheya decora T West, Trans. Micr Soc. Lond., 8 153 1860

The only species in North America. Characters of the genus. Valves imperfectly siliceous, scarcely visible in balsam L. of v. 12–30 µ.

Type locality France

Distribution: Brackish and marine. Local Abundant on the New Jersey coast for a short time in summer

Illustrations: T. West, Trans. Micr. Soc Lond, 8 pl. 7, f. 15; Ralfs, Pritchard, Infusoria, pl. 8, f. 35; A. Schmidt, Atlas, pl. 230, f. 20; Boyer, Diat Philadelphia, pl. 8, f 25, H. L Smith, T. S. 50.

6 Biddulphieae.

Eucampia. Frustules in spiral chains, usually with foramina. Valves elliptical

Ditylum Frustules prismatic. Valves with undulating sides and a stout bristle in the centre.

Biddulphia. Valves elliptical or angular, with the ends or angles elevated or prolonged into horns or spines.

Isthmia. Frustules asymmetrical. Valves with the structure of Biddulphia but elevated at one end only.

Hemiaulus. Frustules compressed Valves with angles produced into horns tipped with a spine. Septa sometimes apparent.

Trinacria. Valves as in *Hemiaulus* but triangular in outline.

31 EUCAMPIA Ehrenb, Ber Akad Berlin, 151 1839.

Frustules in spiral chains, cuneiform in zone view, usually with lanceolate foramina Valves elliptical, with undulating surface, somewhat concave, imperfectly siliceous. Chromatophores,numerous, small rounded granules on the walls of the cells

Type species, *Eucampia zodiacus* Ehrenb

Markings punctate, distinct	1. *E. zodiacus*
Markings indistinct.	2. *E. groenlandica*

1 Eucampia zodiacus Ehrenb., Ber Akad Berlin, 151 1839

Eucampia virginica Grun , Van Heurck, Syn Diat Belg , pl. 95 bis. 1881.
Eucampia britannica W Smith, Syn Brit Diat , 2 25 1856

Valves elliptical, with rounded ends. Surface usually concave at the nodular centre and elevated at the ends, punctate, the puncta, about 7 in 10μ at the centre, radiating and decussating to the sides to about 10 in 10 μ. Ends of the valves hyaline Connective zone annulate, indistinctly punctate, the puncta about 16 in 10 μ. Foramina frequently occur between the frustules. L. of v. 40–95 μ.

E virginica Grun , differs, if at all, from *E zodiacus* in having coarser puncta The former is fossil and the zone view unknown. *E britannica* W Smith, as Peragello remarks, is "the sporangial or megafrustule of the type species The size is double and the valves at first flat become gradually concave, proportional to successive reduplications "

Type locality Miocene deposit of Richmond, Va

Distribution. Pelagic North Atlantic Newport, R. I. (Lewis).

Illustrations Kütz , Bac , pl. 21, f. 21, W Smith, Syn. Brit. Diat , 2 pl. 35, f 299; pl. 60, f 299, pl. 61, f. 378; Van Heurck, Syn. Diat. Belg , pl 95, f. 17, 18, pl 95 bis, f. 1, 2, 6; Perag. Diat Mar. Fr , pl. 95, f 1, 2.

2 Eucampia groenlandica Cleve, Bih. Sv Vet.-Akad Handl 22 (3)^{4}: 10. 1896.

Valves elliptical, with rounded ends Surface concave, the structure indistinct, with a nodular centre and elevated at the ends into short, truncate processes. In zone view the frustules are quadrate, the divisions of the connective zone indistinct. Foramina rounded Diam of frustule 13–20 μ; l. of frustule 32–100 μ. (Cleve)

Type locality Baffin Bay

Distribution Plankton. Davis Strait (Cleve)

Illustrations Cleve, Bih Sv Vet-Akad Handl 22 (3)^{4}. pl 2, f. 10.

32 **DITYLUM** Bail in L. W Bail, Bost Jour Nat. Hist. 7 332 1862

Frustules free or in short filaments, more or less quadrangular in zone view, prismatic or subcylindrical Valves angular or polygonal, with straight or undulating sides Angles ending in a sharp point From the centre of the valve projects a long spine

Type species, *Triceratium intricatum* T West

1 **Ditylum intricatum** (T West) Grun in Van Heurck, Syn Diat Belg. pl 114. 1881
Triceratium intricatum T. West, Trans Micr Soc Lond 8 148 1860
Ditylum trigonum Bail in L W Bail, Bost Jour Nat Hist 7 332 1862

Valves triangular or polygonal, with nearly straight or undulating sides Angles separated by an apparent septate line from the central part Surface convex at the centre or undulating, with punctate striae, the puncta about 20 in 10 μ, in lines radiating from the centre from which rises a long, stout spine Angles elevated, sometimes tipped with mucronate points L of side 60 μ Frustules scarcely siliceous, quite variable in outline according to the stage of growth.

Type locality England

Distribution. Marine Vera Cruz

Illustrations Trans Micr Soc Lond 8 pl 7, f 5, Van Heurck, Syn Diat. Belg pl 114, f 2, Boyer, Diat Phila. pl 38, f 6, 7, H L. Smith, T S 600

33 **BIDDULPHIA** S. F Gray, Arrang. Brit Plants 1 294. 1832 Em Van Heurck, Syn. Diat Belg., 203 1885

Valves elliptical or angular, usually with globular, conical or cylindrical processes, or with angles resembling them, either by elevation or variation in punctation Surface convex, reticulate or punctate, frequently furnished with short or long spines

Type species, *Conferva biddulphiana* Smith

Biddulphia here includes *Denticella*, *Odontella*, *Amphitetras*, *Amphipentas*, *Nothoceratium*, *Triceratium*, *Cerataulus* and *Trigonium*, in whole or in part The classification of the genus is unsatisfactory. Grunow, Van Heurck, De-Toni, Cleve, Peragallo and Mann, have variously interpreted the distinctions in species. The chief difficulty lies in the variation or the absence of the horns, processes or spines and the outline of the valves. The separation of those forms which are distinguished only by their angular outline into *Trigonium* is obviously impossible in the case of the species usually known as *Triceratium arcticum* as they vary from elliptical to triangular and polygonal Certain species under *Cerataulus* approach *Eupodiscus* while others more nearly resemble true Biddulphiae. As *Trigonium*, if adopted, would include a great number of fossil forms of varied type and as these are not here described, and as any further synonymy would be quite inadvisable in the present state of our knowledge, the adoption, provisionally, of some method of classification, in preference to a further unsatisfactory modification, has influenced here the acceptance, with slight changes, of Van Heurck's views. In any case the synonymy given, as the species are well known, will prevent misunderstanding in the identification of forms The three sections which follow represent *Biddulphia* proper, *Triceratium* and *Trigonium* in part.

1 Valves more or less elliptical, rarely angular Processes globose, conical or obtuse, sometimes represented merely by slight elevations or by punctate markings.	
Valves with central inflations and globose processes	1. *B. biddulphiana*
Valves with central inflation larger than the processes	2. *B tridens*
Valves with central part enclosed in two sigmoidal lines Processes slender, capitate	3 *B. mobiliensis*
Valves with central part flattened Processes obtuse A few spines at the centre	4. *B. aurita*
Valves with central part flattened. Processes obtuse Spines absent.	5. *B obtusa*
Valves with central area reaching the sides. Processes short, rounded	6. *B. scutellum*
Valves with central part convex having a central depression. Processes slightly elevated	7. *B. roperiana*
Valves with central part elevated into a quadrate area surrounded by spines.	8. *B. sansibarica*
Valves with central part rounded and surrounded by numerous spines.	9. *B. argus*
Valves with surface covered with numerous spines.	10. *B. edwardsii*
Valves with scattered spines.	11. *B. alaskiensis*
Valves with numerous spines, depressed in the centre. Process appearing hyaline.	12. *B. primordialis*
Valves with radiating punctate lines interrupted by two transverse, hyaline lines.	13. *B. interrupta*

Valves orbicular. Processes hyaline, scarcely elevated.	14	*B rotunda*
Valves with processes inflated at the base and curved to opposite sides A long, stout spine near each process.	15	*B. granulata*
Valves elliptical or triangular, with two or three spines near the margin.	16.	*B. rhombus*
Valves orbicular. A short spine on each side	17	*B smithii*
Valves with two to six long spines near the border, forked at the ends	18	*B spinosa*
Valves with surface elevated into a crown surrounded by long, stout spines.	19	*B. gladiorum*
Valves with two long spines at the centre crossing obliquely the spines of the opposite frustule	20	*B extensa*
Valves rhombic, lanceolate or triangular Markings reticulate.	21	*B. dubia*
Valves with a few scattered spines. Markings reticulate.	22.	*B. reticulata*
Valves with two or three spines near each each border Markings reticulate	23.	*B peruviana*
Valves with two stout spines on each side. Processes obliquely opposite the ends Markings reticulate.	24	*B. keeleyi*
Valves triangular. Processes cylindrical, hyaline. Markings reticulate.	25.	*B. consimilis*
Valves triangular, with a short spine on each side Markings reticulate.	26.	*B. convexiuscula*
Valves with very large, cylindrical, truncate processes. Surface with minute spurs.	27.	*B turgida*
Valves suborbicular or triangular, with short, truncate processes. Two small spines half way between centre and ends.	28.	*B. laevis*
Valves triangular or orbicular, with three or more large, truncate processes.	29.	*B. orbiculata*
Valves elliptical or angular. Markings finely reticulate. Processes absent, but angles with punctate markings	30.	*B. balaena*
Valves elliptical or angular. Markings reticulate. Processes absent, but with ends or angles punctate.	31.	*B. arctica*
Valves triangular. Markings rounded. Processes absent.	32.	*B. luminosa*
Valves triangular, with subcapitate ends. Markings rounded, decreasing to the border.	33.	*B. rustica*

2. Valves angular Markings cellular. Processes conical or cylindrical.

Valves triangular or quadrangular, with large cells parallel to the sides 34 *B. favus*

Valves triangular, with unequal, irregular cells. 35 *B. affinis*

Valves three to eight-angled, with large cells. 36 *B grandis*

Valves triangular or quadrangular, with hexagonal cells subparallel to the margin 37. *B. robertsiana*

Valves pentagonal, with turgid sides. Markings cellular 38 *B. campechiana*

Valves quadrangular. Markings coarse, rounded or angular reticulations in concentric circles 39 *B antediluviana*

Valves quadrangular. Markings coarse reticulations producing the appearance of an inscribed square 40 *B. biquadrata*

Valves quadrangular or pentagonal Markings reticulate, forming a network of various design. 41. *B pentacrinus*

Valves quadrangular, with granular markings in radiating lines 42 *B elegans*

Valves quadrangular Markings interrupted by hyaline lines forming an inscribed square. 43 *B ornata*

3. Valves usually without processes, triangular or polygonal, often with angles separated from the central part. Markings granular.

Valves triangular, with angles divided from the central part by costate lines. Short costae extend inward from the sides. 44. *B tabellarium*

Valves triangular or quadrangular, often irregular. A few indefinite costae extend inward from the sides. 45. *B. alternans*

Valves triangular, with globose processes separated from the centre by hyaline lines 46. *B. trisulca*

Valves four to six-angled. Angles produced, obtuse. Markings radiating from the centre. 47. *B. antillarum*

Valves triangular or polygonal. Markings irregular and unequal, smaller at the angles. 48. *B. reticulum*

Valves triangular, often with unequal sides
Puncta rounded, irregular, scattered 49 *B jucatensis*
Valves quadrangular Markings minute
puncta concentric around a nodular
centre and in parallel rows to the angles. 50. *B. parvula*

1 **Biddulphia biddulphiana** (Smith) Boyer Proc Acad Phila., 53 694. 1901
Conferva Biddulphiana Smith, Eng Bot, pl 1762 (upper figures) 1807 Dillw, Brit Conf, 52 1809
Diatoma biddulphianum Ag, Consp Crit Diat, 54 1832
Biddulphia pulchella S F Gray, Arrang Brit Plants, 1 294 1821

Many other synonyms might be given While the upper figures in Eng Bot pl 1762, appear to represent this form the synonymy has, as Peragallo remarks, become inextricable

Frustules in filaments, generally found free, quadrangular, inflated at the angles into large, rounded processes. Valves elliptical, convex, divided transversely by two or more costae, sides undulating At each end a globular process, constricted at the base. At the centre of the valve, usually less elevated than the processes, are two or three short spines Surface reticulated, the reticulations coarse, about 3 in 10 µ, smaller at the centre where they are concentrically arranged around an elliptical or oblong space transverse to the major axis, and small and granular on the processes Connective zone well developed, except in young frustules, with reticulations in nearly parallel rows, about 5 in 10 µ, with a single row of larger cells on each border L of v to 115 µ Variable in size, outline and the number of costae In some forms the undulations of the sides are angular, in others the costae anastomose.

Type locality England

Distribution Marine Atlantic and Pacific coasts

Illustrations Eng Bot, pl 1762 (upper figures only), W Smith, Syn Brit Diat, 2 pl 44, f 321; Pritchard, Infusoria, pl 2, f. 46–50; Van Heurck, Syn Diat Belg, pl 97, f. 1–3, Boyer, Diat. Philadelphia, pl 7, f. 1–4.

Biddulphia biddulphiana abnormis (A Schmidt), Atlas, pl. 121, f. 2. Valves broadly elliptical in general outline, with undulating sides, each of which has a well-defined, small process in the middle. The four or five costae on each side converge and unite with a costa surrounding an oblong central space. Jamaica.

2 **Biddulphia tridens** Ehrenb., Ber Akad. Berlin, 205 1840.
Zygoceros tuomeyi Bailey, Amer Jour Sci, 46 138 1844
Biddulphia tridentata Ehrenb, Ber Akad. Berlin, 69 1844, Mikrogeol, pl 20, f 53. 1854
Biddulphia tuomeyi (Bailey) Roper, Trans. Micr Soc Lond 7 8 1859.

Frustules in zone view with hemispherical elevations, of which the middle is always the largest. Valves in general outline lanceolate, with undulating sides, divisions separated by septa, three or more, inflated, usually with several small spines. Processes more elevated than the divisions, inflated at the base. Surface punctate, the puncta unequal, scattered or in longitudinal rows L. of v to 210 µ. In a specimen from Campeche Bay numerous short spines are scattered over the surface, more prominent than in other forms.

Type locality: Miocene deposits of Maryland and Virginia.

Distribution. Marine. Campeche Bay. Virgin Islands

Illustrations Bailey, Amer. Jour. Sci, 46. pl. 2, f 3, 4; Roper, Trans. Micr Soc. Lond, 7 pl. 1, f. 1, 2, Pritchard, Infusoria, pl. 6, f. 10, Van Heurck, Syn. Diat Belg., pl 98, f 2, 3; A. Schmidt, Atlas, pl 119, f. 1–9, 16, 16.

3 **Biddulphia mobiliensis** (Bailey) Grun., Van Heurck, Syn. Diat. Belg., pl. 101 1881

Zygoceros (Denticella?) mobiliensis Bailey, Smith Contr., 2^{8}. 40 1851
Biddulphia baileyi W. Smith, Syn Brit Diat. 2. 50. 1856.

Valves elliptical-lanceolate, convex, with a flat central part enclosed in two sigmoid lines extending between the processes On opposite sides of the central part at a variable distance from either end is a small conical elevation from which extends a very long slender spine or bristle. Processes slender, capitate. Surface of valve "delicately decussately punctate," the puncta about 15 in 10 µ. L. of v 60–75 µ. Frustules delicate, of a yellowish color.

Type locality Mobile Bay

Distribution. Marine Atlantic and Pacific coasts.

Illustrations Bailey, Smith Contr. 2. pl. 2, f. 34, 35; Pritchard, Infusoria, pl 6, f 11, W. Smith, Syn. Brit. Diat., 2 pl. 45, f. 322, pl. 62, f 322, Roper, Trans. Micr. Soc. Lond., 7: pl. 1, f. 5–9. 1859, Van Heurck, Syn. Diat. Belg., pl. 101, f. 4–6, pl. 103, f. A; A. Schmidt, Atlas, pl. *122*, f. *20*, *21*.

4. **Biddulphia aurita** (Lyngb) Bréb., Mém. Soc. Sci. Falaise, 12 1838.

Diatoma auritum Lyngb, Tent Hydroph. Dan., 182 1819.
Odontella aurita (Lyngb.) Ag, Consp Crit Diat, 56. 1832.
Denticella aurita Ehrenb, Mikrogeol, pl. 35, 1854.

Frustules in filaments, quadrangular. Connective zone with longitudinal rows of puncta about 10 in 10 µ. Valves elliptical-lanceolate, convex at the centre, with obtuse processes inflated at the base Central part of valve more or less flattened at the top from which a few long spines project. Surface punctate, the puncta about 10 in 10 µ, radiating from an obscure or elliptical centre. L. of v. 83 µ. A variable species. In the Miocene deposits the puncta are sometimes coarser.

Type locality: Denmark.

Distribution· Marine. Atlantic and Pacific coasts.

Illustrations Lyngb., Tent. Hydroph. Dan pl 62, f. D, Ehrenb., Mikrogeol., pl 35, A, f. 7; W. Smith, Syn. Brit. Diat, 2. pl 45, f. 319; Van Heurck, Syn Diat. Belg, pl. 98, f 4–9, A Schmidt, Atlas, pl. 122, f 1–8; Perag., Diat Mar Fr, pl 98, f 3, 5, 6

5 **Biddulphia obtusa (Kütz.) Ralfs, in Pritchard Infusoria, 848 1861**

Odontella obtusa Kütz, Bac, 137 1844

Frustules quadrangular, with angles inflated into large, rounded processes Valves elliptical-lanceolate, slightly flattened in the centre. Surface punctate, the puncta 7 in 10 µ L of v 30 µ. Differs from *B aurita* in the absence of central spines and in the shortness of the processes, but the distinction is not always apparent as they both sometimes have similar processes inflated at the base.

Type locality Europe

Distribution Marine Atlantic and Pacific Coasts.

Illustrations Kütz, Bac pl. 18, f 1–3, 6–8, Pritchard, Infusoria, pl. 13, f. 30, 31; Van Heurck, Syn Diat Belg, pl 100, f 11–14; A. Schmidt, Atlas, pl 122, f 30, 31; Perag, Diat Mar Fr, pl. 98, f. 2.

Biddulphia subaequa (Kütz) Ralfs, Pritchard, Infusoria, 848 (*Odontella subaequa* Kütz Bac, 137, pl 18, f 4, 5), appears to be a smaller form of *B obtusa* without the central concavity of the valve. The form in A Schmidt, Atlas, pl 141, f 11, does not correspond to Kützing's.

6. **Biddulphia scutellum Mann, Contr U S. Nat. Herb. 10^5 309 1907**

Valves elliptical, convex. Central space flat with puncta radiating "from two approximate foci" to the sides; the remaining part of the valve with puncta in lines parallel to the major axis Surface with scattered spines. Processes short, circular, at the ends of the valve L of v. 152 µ (Mann, in part)

Type locality Aleutian Islands

Distribution Marine. Known only from the type locality

Illustrations: Mann Contr. U. S Nat. Herb 10^5. pl. 47, f. 3.

7. **Biddulphia roperiana Grev, Quart. Jour Micr Sci. 7: 163. 1859.**

Valves broadly elliptical-lanceolate Surface convex with a central depression, punctate, the puncta about 7 in 10 µ, radiating from the centre. Connective zone with puncta in longitudinal rows. L. of v. 45–165 µ.

Type locality. California.

Distribution Marine. Pacific Coast

Illustrations. Grev, Quart. Jour. Micr. Sci. 7: pl. 8, f. 11–13; Van Heurck, Syn. Diat. Belg. pl. 99, f. 4–6; H L. Smith, T S. 625.

Biddulphia roperiana coronata Mereschk, Polynesian Diatoms, (Scripta Botanica, Horti Universitatis Petropolitanae, Fasc. 18, 17 1902) A circlet of spines surrounds the central part. British Columbia (Mereschk)

Numerous variations of *B aurita*, *B. obtusa* and *B Roperiana* associate these forms closely

8 **Biddulphia zanzibarica** A. Schmidt, Atlas, pl 122 1888

Valves broadly elliptical Surface elevated at the centre into a quadrate or transversely elliptical area surrounded by several stout spines Markings 10 in 10 µ L of v 40–50 µ Near *B aurita* (Lyngb) Bréb

Type locality· Zanzibar

Distribution Marine Guadaloupe.

Illustrations A Schmidt, Atlas, pl 122, f. 10–12.

9 **Biddulphia argus** Boyer, Proc Acad Phila 50 469. 1898.

Valves broadly elliptical, convex, with an elliptical depression at the centre which is encircled by from ten to twelve short spines Processes short, obtuse Surface with hexagonal reticulations radiating in curved lines, about 5 in 10 µ at the centre and 3–4 in 10 µ at the border L. of v. 165 µ

Distinguished from *B Roperiana* by the central spines and the size of the reticulations A form occurs at Port Townsend Bay resembling the unnamed species in A Schmidt, Atlas, pl 120, f. 27, in which a circlet of spines is seen See also *B. roperiana coronata* Mereschk

Type locality Port Antonio, Jamaica.

Distribution Marine. Known only from the type locality

Illustrations Boyer, Proc Acad Phila. 50. pl 24, f. 6

10. **Biddulphia edwardsii** (Febiger Ms.) H L. Smith, T S. No. 623 1879.

Odontella edwardsii Grun, Van Heurck, Syn Diat Belg, pl. 100 1881.

Valves elliptical, convex, flattened in the centre. Surface punctate, the puncta 7–10 in 10 µ, radiating from the centre. In zone view the frustule is quadrangular, with short, rounded processes, the puncta in longitudinal rows. The entire surface of the valve covered with small spines and, occasionally with larger ones. L. of v. 33–105 µ,

Type locality Coast of California

Distribution· Marine. Pacific Coast.

Illustrations Grun., Denks. Akad. Wien 48: pl. 2, f. 20; Van Heurck, Syn. Diat Belg, pl. 100, f. 9, 10.

11 **Biddulphia alaskiensis** Mann. Contr U S. Nat Herb 10^5 298 1907

Valves broadly elliptical or orbicular, convex, with processes slightly elevated. Markings granular, minute, in radiating lines slightly curved toward the processes Surface with a few scattered spines and a larger spine near each margin one-fourth the distance from either end Border narrow, hyaline L of v 63 µ (Mann)

Type locality Behring Sea

Distribution Marine Known only from the type locality

Illustrations Mann, Contr U S Nat. Herb 10^5. pl 46, f. 1.

12 **Biddulphia primordialis** Brun Mém Soc Phys Hist. Nat Genève 31^1 12 1891

Valves broadly elliptical, convex Processes large, rounded, minutely punctate, appearing hyaline Surface depressed in the centre, with scattered granules which radiate in finely punctate lines to the border where they are about 10 in 10 µ. Scattered over the surface are numerous, short, stout spines. Border hyaline. L of v to 250 µ

Type locality Sendai, Japan, fossil deposit

Distribution Coast of Alaska (Mann)

Illustrations Brun, Mém Soc Phys Hist Nat Genève 31^1 pl 13, f 9, pl 14, f 9, A Schmidt, Atlas, pl 172, f 4

13 **Biddulphia interrupta** Boyer Proc Acad Phila 50 468 1898

Valves elliptical, with small, rounded processes Surface convex, finely punctate, the puncta 10–15 in 10 µ, radiating in scattered lines from the centre at which are two or three minute spines. At one-third the radius from the centre to the processes the puncta are interrupted by a transverse hyaline band which extends nearly to the sides L of v. 100 µ

Type locality Campeche Bay

Distribution Marine. Known only from the type locality.

Illustrations Boyer, Proc Acad Phila , 50. pl 24, f 2

14. **Biddulphia rotunda** Perag in Tempère & Perag., Diatomées du Monde entier, 66 1915

Valves orbicular Processes not prominent Puncta radiating 9 in 10 µ Several, usually two to three, small spines at about half the radius from the centre. L of v. 60–70 µ. Near *B. obtusa* (Kütz.) Ralfs

Type locality· Port Townsend, Wash

Distribution· Marine Pacific Not rare.

15 **Biddulphia granulata** Roper, Trans. Micr Soc Lond , 7 13 1850

Denticella turgida Ehrenb , Ber Akad Berlin, 207. 1840.?
Odontella turgida Kütz., Bac , 137 1844 ?

Valves elliptical-lanceolate, convex, with puncta in oblique rows about 12 in 10 µ. Processes slightly inflated at the base, obtuse at the ends and curved toward opposite sides. Surface usually covered with small spines. Near each process, on opposite sides of the longitudinal axis, a long, stout spine, bent or curved inward near the middle In zone view the general outline is that of *B. aurita.* Connective zone with decussating puncta smaller than those on the valves. L of v. 50–95 µ.

Type locality. England.

Distribution· Marine Verz Cruz Pacific Coast.

Illustrations. Roper, Trans. Micr. Soc. Lond, 1: pl 1, f. 10, 11, pl 2, f. 12; A. Schmidt, Atlas, pl. 122, f. 18, 26, 27; Van Heurck, Syn Diat Belg, pl 99, f 7, 8; Boyer, Diat Philadelphia, pl 7, f. 6

16 **Biddulphia rhombus (Ehrenb) W Smith, Syn Brit Diat., 2 49 1856**

Zygoceros rhombus Ehrenb., Ber. Akad Berlin, 156 1839.

Valves rhombic-elliptical or triangular. Processes small, short and obtuse Surface convex, with fine reticulations, 7–9 in 10 µ, irregular at the centre, thence radiating to the margin Minute spines are scattered over the surface and, on each side, near the margin, several spines, usually two or three, occur L of v. to 165 µ. In the triangular form there are usually two spines near each angle

Type locality· Europe

Distribution Marine. Atlantic Coast.

Illustrations Ehrenb, Ber. Akad. Berlin, pl. 4, f. 9, 11; Kütz, Bac. pl 18, f 9, 10, W Smith, Syn Brit. Diat, 2 pl 45, f. 320; A. Schmidt, Atlas, pl. 120, f 11–13, Boyer, Diat. Philadelphia, pl 7, f. 5, Van Heurck, Syn. Diat. Belg, pl 99, f 1, 3.

17 **Biddulphia smithii (Ralfs) Van Heurck, Syn Diat. Belg., 207 1885**

Eupodiscus radiatus W. Smith (not Bailey), Syn Brit. Diat., 1. 24 1853.
Biddulphia radiata (W Smith) Roper, Trans. Micr. Soc. Lond, 7 19. 1859.
Cerataulus Smithii Ralfs, Pritchard, Infusoria 847 1861

Valves orbicular. Surface convex, with hexagonal reticulations, about 6 in 10 µ, in oblique or radiating, curved, decussating lines. Processes conical, obtuse Between the processes, on each side, a short spine is found. Connective zone narrow, with longitudinal rows of puncta, 10–12 in 10 µ. Diam. 60 µ.

Type locality England.

Distribution Marine. Atlantic Coast, southward.

Illustrations. W. Smith, Syn. Brit. Diat., 1: pl. 30, f. 255; 2: pl. 62, f. 255; Roper, Trans. Micr. Soc. Lond., 1: pl. 2, f. 27–29; Van Heurck, Syn Diat. Belg. pl. 105, f. 1, 2; Boyer, Diat. Philadelphia, pl. 7, f. 8.

18 **Biddulphia spinosa** (Bailey) Boyer. Proc. Acad. Phila. 53 703 1901

Triceratium spinosum Bailey, Amer Jour Sci 46 139 1844
Triceratium tridactylum Brightw, Quart Jour Micr Sci 1 248 1853
Triceratium setigerum Bailey, Smith. Contr 7 11 1854
Triceratium armatum Roper, Quart Jour Micr Sci 2 283 1854
Triceratium serratum Wallich, Quart. Jour Micr Sci 6 243. 1858.

Not *Biddulphia spinosa* Grev, Trans Micr Soc Lond, 13 6. pl. 1, f 3. 1865. Brightwell (Quart Jour Micr Sci 4 276. 1856) unites *T spinosum*, *T setigerum*, *T armatum* and *T tridactylum* into one species which he says "should be called *T spinosum*."

Valves triangular or quadrangular, with straight or slightly concave sides. Angles produced into rounded processes Surface convex, reticulated, the cells hexagonal, 4–5 in 10 µ at the centre, 6–7 in 10 µ at the sides, with minute spurs at irregular intervals. Two to six long spines occur near the border, forked at the ends, in perfect specimens L. of side to 156 µ

Type locality Florida.

Distribution Marine Campeche Bay Yucatan Jamaica.

Illustrations Bailey, Amer. Jour. Sci 46· pl 2, F; Smith Contr. 7. pl. f 26, Roper, Quart. Jour Micr Sci., 2. f 1, Wallich, Quart. Jour. Micr. Sci., 6· pl 12, f. 1, 2; Pritchard, Infusoria, pl 6, f 19; A Schmidt, Atlas, pl 87, f 2–5, Perag, Diat Mar Fr, pl 98, f. 8, 9

19. **Biddulphia gladiorum** Mann Contr U S. Nat. Herb 10^5 304. 1907

Valves elliptical Surface flat, elevated in a crown surrounded by five long, stout spines or setae, suddenly descending to the margin. Markings delicate, the puncta in oblique rows Processes scarcely elevated, oblique. L. of v 110 µ (Mann, in part). Approaches *B. circinus* (Bail.) Van Heurck, occurring in the Miocene of Richmond, Va. and Santa Monica, Cal

Type locality Behring Sea.

Distribution· Marine. Known only from the type locality

Illustrations: Mann, Contr. U. S. Nat. Herb. 10^5. pl. 47, f. 4

20. **Biddulphia extensa** Mann, Contr U S. Nat. Herb. 10^5: 302 1907

Biddulphia sp L. W. Bailey, Trans. Roy Soc Canada 9 162 1915?

Valves elliptical, the major axis four and a half times the minor. Markings granular, radiating from a hyaline central area and forming concentric ellipses on each half of the valve. Two stout, straight, long spines, one on each side of the central area, extend obliquely upward and cross the spines of the opposing valve of the adjacent frustule. In zone view the valves are convex in the centre and the horns slender and capitate-truncate Adjacent frustules united not only by the spines but by a pellucid film-like siliceous membrane. L. of v. 130 µ (Mann, in part). Bailey's species, a form of which I have examined in zone view, 90 μ in l. of v., appears to correspond, except that it is without the film-like membrane

Type locality Monterey Bay, Cal. (Mann).

Distribution Marine Vancouver, B C. ? (Coll L W. Bailey).

Illustrations Contr. U S. Nat. Herb. 10^{5}· pl. 47, f 1, 2

21 **Biddulphia dubia** (Brightw) Cleve, Vega Exp. Iaktt. 3 508. 1883.

Triceratium dubium Brightw., Quart Jour Micr Sci, 7 180 1859
Triceratium (or *Biddulphia*) *bicorne* Cleve, Bih Sv Vet-Akad Handl 5^{8} 17 1878

Valves rhombic-lanceolate or triangular, the ends or angles produced into obtuse processes, while the sides are turgid and extended into rounded projections. Irregular forms are frequent Surface coarsely reticulate, the reticulations unequal, angular, about 3 in 10 μ, distinctly punctate Distance between the produced angles 49–108 μ

Type locality Mauritius

Distribution· Marine Atlantic and Pacific Coasts

Illustrations. Brightw., Quart Jour Micr. Sci 7 pl. 9, f 12, Cleve, Bih Sv. Vet-Akad Handl 5^{8}· pl 5, f 30; A Schmidt, Atlas, pl. 78, f. 24–25

22 **Biddulphia reticulata** Roper Trans. Micr Soc. Lond 7 14. 1859

Valves elliptical-lanceolate, convex. Surface reticulate, the reticulations hexagonal, 3–4 in 10 μ, punctate. A few minute spines usually scattered over the valve Processes short, obtuse. Connective zone with parallel rows of puncta about 5 in 10 μ L. of v 50–122 μ. Resembles *B dubia* in the reticulations but the sides are not turgid.

Type locality Natal

Distribution Marine Honduras. Jamaica Pacific coast

Illustrations: Roper, Trans Micr. Soc. Lond. 7 pl. 2, f. 13, 14; Janisch & Rab in Rab. Beitr. Alg 1. pl. 3, f 17, Van Heurck, Syn. Diat. Belg., pl. 102, f 1, 2, A Schmidt, Atlas, pl 121, f. 11–15.

23. **Biddulphia peruviana** Grun., in Van Heurck, Syn Diat. Belg., pl. 101 1881

Valves rhombic-elliptical or elliptical-lanceolate, convex, slightly constricted above the connective zone and surrounded by a narrow, hyaline band Processes conical, inflated at the base, obtuse. Surface reticulate, the reticulations radiating, 4–5 at the centre, about 6 at the border; in 10 μ, minutely punctate. Two or three strong spines usually occur on each side near the border. Connective zone with diagonal reticulations about 7 in 10 μ. L. of v. 67–138 μ.

Type locality· Peruvian guano.

Distribution. Marine. Callao, Peru. May occur northward.

Illustrations· Van Heurck, Syn. Diat. Belg , pl. 101, f. 2, 3

24. **Biddulphia keeleyi** Boyer, Proc. Acad Phila., 50: 469. 1898

Valves rhombic-elliptical Surface convex, reticulate, the reticulations unequal, 2½–3 in 10 µ, punctate. Three stout spines are found on each side near the margin. Processes inflated at the base, small at the apex, placed obliquely opposite, near the ends. L of v. 95–148 µ.

Type locality. Pacific Ocean.

Distribution Marine Monterey Bay, Cal

Illustrations. Boyer, Proc Acad Phila. 50. pl. 24, f. 4.

25 **Biddulphia consimilis** (Grun.) Boyer, Proc. Acad Phila , 53: 709. 1901

Triceratium consimile Grun , Van Heurck, Syn. Diat. Belg , pl. 108. 1881.

Valves triangular, with convex sides and slightly convex surface Angles rounded, filled with the prominent, cylindrical, short, hyaline processes Surface reticulate, the reticulations angular, irregular and unequal, with the punctate markings of the inner plate in five or six rows, parallel to one side of each cell but not radiating from a common centre L of v 120–198 µ

Type locality Santa Monica deposit, Cal

Distribution Marine. Campeche Bay.

Illustrations. Van Heurck, Syn. Diat Belg , pl 108, f 2; A Schmidt, Atlas, pl. 84, f. 13, 14. None of the figures shows the striae correctly

26 **Biddulphia convexiuscula** (Grun.) Boyer, Proc Acad. Phila., 53 709. 1901.

Triceratium convexiusculum Grun , A. Schmidt, Atlas, pl. 151.

Valves triangular, with convex sides. Angles rounded, with short, truncate, hyaline processes. Surface convex, with hexagonal reticulations, about 7 in 10 µ, radiating from the centre On one or both sides of each angle is a short spine L of side 50–70 µ.

Type locality Campeche Bay.

Distribution Marine. Honduras Coast of South Carolina. Tampa Bay, Fla.

Illustrations· A. Schmidt, Atlas, pl. 151, f. 5, 6.

27 **Biddulphia turgida** (Ehrenb.) W Smith, Syn. Brit. Diat., 2: 50. 1856.

Cerataulus turgidus Ehrenb , Ber Akad Berlin, 171 1843.
Odontella turgida (W Smith) Van Heurck, Syn Diat. Belg , pl 108. 1881.

Valves elliptical, convex. Processes very large, cylindrical, truncate, obliquely opposite, near the ends, and owing to the torsion of the frustule, directed sideways. Surface with undulating lines of puncta about 9 in 10 µ, and minute spurs at intervals. Between the processes on each side is a stout spine, frequently forked in perfect specimens. A row of small spines is occasionally found around the margin In zone view the frustule appears subglobose and twisted on its longitudinal axis so that the edges of the valves appear undulating and the connective zone sigmoid. Puncta on the connective zone in quincunx, about 11 in 10 µ. L of v. 70–130 µ

Type locality Europe

Distribution Atlantic and Pacific Coasts

Illustrations W Smith, Syn Brit Diat., 2. pl 62, f 384, Roper, Trans Micr Soc Lond 7 pl. 2, f. 23 1859, Bailey, Smith. Contr. 2 pl 2, f 26, 27 1850, A Schmidt, Atlas, pl. 116, f 1–3; pl 115, f 12–14; Van Heurck, Syn Diat Belg, pl 104, f 1, 2; Perag, Diat Mar Fr, pl 107, f 7–9, Boyer, Diat Philadelphia, pl 7, f 7.

28 **Biddulphia levis Ehrenb, Ber Akad Berlin 1843 122 1843.**

Cerataulus levis (Ehrenb) Ralfs, Pritchard, Infusoria, 847 1861

Valves suborbicular, or occasionally subtriangular Processes short, truncate Surface convex, with puncta about 13 in 10 µ, radiating in more or less curved lines Two small spines occur on opposite sides, about half the radius from the centre, usually nearer one process than the other Minute spurs, invisible under ordinary illumination, apparently cover the surface On the connective zone the puncta are slightly smaller L of v 65 µ, but sometimes much larger Sporangial frustules or auxospores, discovered by T Chalkley Palmer, are formed in somewhat the same way as in *Melosira varians* (Boyer, Diat Phila, 33, pl 7, f. 10; also Roper, Trans Micr Soc Lond 7 18 1859) F J Keeley has found at De Leon Springs, Fla, auxospores formed at right angles to the filament

Type locality Hudson River

Distribution Marine, brackish and fresh water. Atlantic and Pacific Coasts. Fossil in salt marsh deposits of Kansas, Utah, Nebraska and Michigan Recent in fresh water, Nebraska (Coll. C J Elmore) and elsewhere

Illustrations: Trans. Micr. Soc. Lond 7 pl 2, f 24–26, Van Heurck, Syn Diat Belg pl 104, f 3, 4, A Schmidt, Atlas, pl 116, f 7–11, 13–15; Perag Diat. Mar. Fr. pl. 107, f. 1–5; Boyer, Diat. Phila. pl 7, f 9, 10.

29 **Biddulphia orbiculata (Shadb.) Boyer, Proc. Acad. Phila. 53 709. 1901**

Triceratium orbiculatum Shadb, Trans. Micr Soc. Lond. 2: 15 1854.
Triceratium Shadboldtianum Grev., Trans. Micr. Soc. Lond 10. 28 1862.

For synonymy see Boyer, Proc. Acad. Phila. 53 709, 1901, and Mann, Contr. U. S. Nat. Herb. 10: 310, 1907. Peragallo separates *T. orbiculatum* and *T. shadboltianum* only because the first name, which has priority, is not appropriate to the second on account of outline. As the outline is not essential and as forms occur on the coast of Barbadoes which are intermediate, they are considered here as the same *Lampriscus kittonii* A Schmidt, Atlas, pl 80, f. 11, from Colon, appears to be a variation of this form *Triceratium gibbosum crenulatum* Grun., which, apparently, is equivalent to *Biddulphia crenulata* Walker (Some New and Rare Diatoms, Walker and Chase, pl 2, f 7 1887) occurs in Pacific soundings. In specimens observed the difference between it and *B orbiculata* is in the crenulation of the margin.

Valves triangular, with convex sides, or orbicular Processes three or more, large, elevated and truncate A short spine is frequently found near one or more of the processes Surface punctate, the puncta in radiating lines Connective zone much elongated, with puncta in longitudinal and oblique rows, about 6 in 10 μ. L of side 60–90 μ

Type locality. Natal

Distribution Marine Honduras Coast of Barbadoes

Illustrations Shadb, Trans Micr Soc Lond, 2 pl 1, f 6, Janisch & Rab., in Rab Beitr Alg 1 pl 2, f. 5, Grun, Trans Roy. Micr Soc 18. pl 196, f 2, 1877, A Schmidt, Atlas, pl 80, f 19, 20.

30. **Biddulphia balaena** (Ehrenb) Brightw, Quart. Jour Micr Sci. 7 181 1859

Zygoceros balaena Ehrenb, Mikrogeol, pl 35 1854
Zygoceros radiatus Bailey, Smith Contr, 7 11 1854.

Valves elliptical or angular Surface nearly flat, slightly elevated at the angles, finely reticulate, the reticulations about 8 in 10 μ, radiating in the smaller forms but transverse in the middle in the larger valves. Connective zone with parallel rows of fine puncta L of v. to 231 μ

Distinguished from *B arctica* by its much finer reticulations In *B arctica* the cells are finely punctate but the puncta are not evident in *B baleana*. Forms occur, however, which appear to be intermediate between the two The distinction can be readily seen by a comparison of H. L Smith's Type Slide No 624 and the common forms from Port Townsend and the Pacific coast and by Peragallo's figures in Diat. Mar Fr., pl. 105, where f 1 and 2 represent *B balaena* and f. 3, given as *B. balaena arctica*, is an elliptical variety of *B. arctica*.

Type locality Arctic Sea.

Distribution: Marine. Arctic Sea. Greenland. McCormack Bay. Nova Scotia Colon.

Illustrations: Ehrenb., Mikrogeol., pl. 35, A, 23, f. 17, Bailey, Smith Contr., 7: f. 29; Brightw., Quart. Jour. Micr. Sci., 7: pl. 9, f. 15. 1859; Perag., Diat. Mar. Fr., pl. 105, f. 1, 2.

31 **Biddulphia arctica (Brightw.) Boyer, Proc. Acad. Phila., 53: 714. 1901**

Triceratium arcticum Brightw., Quart. Jour. Micr. Sci. 1: 250. 1853
Trigonium arcticum (Brightw.) Cleve, Bih. Sv. Vet.-Akad. Handl. 1^{18}: 8. 1873

Valves elliptical or angular, with straight, concave or convex sides. Angles scarcely elevated. Surface of valve reticulate or cellular, the cells irregularly pentagonal or hexagonal, about 3 in 10 μ, usually larger at the semi-radius, radiating from the centre, distinctly punctate. Angles finely punctate in parallel rows. Connective zone with coarse puncta in longitudinal rows. Zone view usually quadrangular, but occasionally showing the surface of the valves much elevated. L. of side quite variable, usually about 125 μ.

Type locality: Beachy Island, Arctic Sea.

Distribution: Marine. Arctic Sea. Pacific coast.

Illustrations: Brightw., Quart. Jour. Micr. Sci., 1: pl. 4, f. 11; A. Schmidt, Atlas, pl. 79, f. 12; Perag., Diat. Mar. Fr., pl. 104, f. 1, 2.

Biddulphia arctica formosa (Brightw.) Perag., Diat. Mar. Fr., 379. pl. 104, f. 3, 5. 1902. *Triceratium formosum* Brightw., Quart. Jour. Micr. Sci. 4: 274. pl. 17, f. 8. 1856. Valves three, four or five angled, with concave sides, less obtuse angles than in the type and with reticulations 5–6 in 10 μ. Intermediate between the type forms of *B. arctica* and *B. balaena*, to the latter of which it is united by Van Heurck (Treat. Diat., 61. 1896). A. Schmidt, Atlas, pl. 79, f. 2–4. Pacific Coast and in the pentagonal form on the coast of Barbados.

Biddulphia arctica californica Grun., A. Schmidt, Atlas, pl. 79, f. 5, 6. Occurs three and four angled. Pacific Coast.

Biddulphia arctica japonica Grun., A. Schmidt, Atlas, pl. 79, f. 10, 11. With nearly straight sides. Pacific Coast.

Biddulphia arctica campechiana Grun., Van Heurck, Syn. Diat. Beg., pl. 112, f. 1. Triangular, with straight sides. Campeche Bay.

Biddulphia arctica sexangulata Boyer, Proc. Acad. Phila. 53: 715. 1901. Six angled, with concave sides. Markings 2–2½ in 10 μ. Diam. 170 μ. Coast of California. Not *Triceratium sexangulatum* Grev.

32 **Biddulphia luminosa** (Temp. & Brun) Mann, Contr U S. Nat. Herb. 10^{5}: 305. 1907

Triceratium luminosum Temp & Brun, Mém Soc. Phys Hist Nat. Genève 30^{9} 62 1889.

Valves triangular, with slightly convex sides. Angles scarcely elevated, punctate. Surface of valve with rounded cells, 3 in 10 µ in the centre, 4 in 10 µ near the sides. Border hyaline. Diam. of v. 83–153 µ (Brun and Mann, in part) According to Mann the cells are without the central dot occurring in the Japan form

Type locality · Sendai, Japan, fossil deposit.

Distribution Coast of California and Behring Sea (Mann).

Illustrations Mém. Soc. Phys Hist Nat Genève 30^{9} pl 6, f. 3; A Schmidt, Atlas, pl 159, f. 6, Contr U. S. Nat Herb. 10^{5}. pl 46, f. 5

33 **Biddulphia rustica** (Mann)

Trigonium rusticum Mann, Contr U S Nat. Herb 10^{5} 294 1907

Valves triangular, with convex sides and produced, rostrate-capitate angles. Surface with coarse and scattered reticulations, about 4 in 10 µ at the centre, radiating and decreasing to about 7 in 10 µ at the border A minute spine at the end of each process or angle L. of side 60 µ (ex icone)

Type locality Behring Sea (Mann)

Distribution · Marine Known only from the type locality.

Illustrations Contr U S. Nat. Herb 10 pl 51, f. 4.

34 **Bidduplhia favus** (Ehrenb.) Van Heurck, Syn. Diat Belg, 208 1885

Triceratium favus Ehrenb, Ber Akad Berlin, 159 1839

Valves triangular or quadrangular, with straight or slightly concave or convex sides Angles produced into horn-like, obtuse processes Surface slightly convex, divided into large, hexagonal cells arranged in rows parallel to the sides Inner surface of valve finely punctate, the puncta, about 18 in 10 µ, radiating in undulating rows from the centre. Zone view quadrangular, with puncta in quincunx. Frustules attached by their angles in zigzag chains, usually found free L of side about 150 µ

Type locality Europe

Distribution Marine. Atlantic Coast, especially the Gulf of Mexico.

Illustrations Ehrenb, Ber Akad Berlin pl. 4, f. 10. 1839; Mikrogeol pl 19, f 17; Van Heurck, Syn Diat. Belg., pl 107, f 1–5; A. Schmidt, Atlas, pl. 82, f 1–4, Boyer, Diat. Phila., pl. 6, f. 6.

Biddulphia favus scitula (Brightw) Valves as in the type form but smaller and with the cells not always parallel to the sides. *Triceratium scitulum* Brightw., Quart Jour. Micr. Sci. 1 · 250. pl. 4, f. 9 ·1853. A Schmidt, Atlas, pl 84, f 6 Campeche Bay.

Colon. Forms occur intermediate between the type and the variety.

Triceratium muricatum Brightw., *Triceratium megastomum* Brightw., and *Triceratium fimbriatum* Wallich, are sometimes considered as equivalent to *Biddulphia favus* but as their type forms are not North American they are not here described.

35 **Biddulphia affinis** (Grun) Van Heurck, Exp. Antarct Belge Diat 81 1909.

Triceratium affine Grun , in Van Heurck, Syn. Diat Belg pl 108. 1881.

Valves triangular, with straight sides Angles produced into small, horn-like, obtuse processes Surface convex, with unequal, hexagonal cells in irregular, subradiate rows, not parallel to the sides, smaller at the border Inner stratum finely punctate, the puncta radiating from the centre. L. of side 150 μ.

Type locality "Unknown fossil deposit."

Distribution Marine. Fernandina, Florida West Indies Rare.

Illustrations Van Heurck, Syn. Diat Belg , pl. 108, f. 3

36 **Biddulphia grandis** (Brightw) Boyer, Proc Acad Phila 53 706 1901

Triceratium grande Brightw , Quart Jour Micr Sci 1 249 1853

Triceratium grande septangulatum Kitton, in A Schmidt, Atlas, pl 85 1885.

Valves three to eight angled, larger than in *B favus*. Cells large, hexagonal Puncta of the lower stratum sometimes 7 in 10 μ L of side to 281 μ.

Type locality Indian Ocean

Distribution Marine Colon. Pacific Coast.

Illustrations Brightw , Quart Jour Micr Sci. 1 pl. 4, f 8; A Schmidt, Atlas, pl. 82, f. 5, pl. 85; f. 1, 2

37 **Biddulphia robertsiana** (Grev) Boyer, Proc. Acad Phila., 53: 707 1901

Triceratium robertsianum Grev , Quart Jour Micr Sci. Ser , 2 3: 231 1863.

Valves triangular or quadrangular, with convex sides. Surface convex, with hexagonal cells subparallel to the sides. Processes short, cylindrical, obtuse Inner plate of valve punctate as in *B favus*. One or more short, stout spines usually occur on each side. L of side to 148 μ.

Type locality. Queensland.

Distribution Pacific Coast. Gulf of Mexico

Illustrations Grev., Quart. Jour Micr Sci , Ser. 2, 3 pl. 9, f 9; Trans Micr. Soc Lond , 14: pl. 2, f 22. 1866; A. Schmidt, Atlas, pl. 82, f 14, 15, pl. 83, f. 2–7.

38. **Biddulphia campechiana** (Grun.) Boyer, Proc Acad Phila., 53: 707 1901

Triceratium campechianum Grun , Cleve, Bih. Sv Vet -Akad. Handl. 5^{8}: 16 1878

Triceratium alternans A. Schmidt, Atlas, pl. 78 (in errore)

Valves pentagonal, with sides tumid in the middle, producing a decagonal outline. Processes at the angles short, conical, obtuse. Surface slightly convex, reticulated, the cells hexagonal, nearly equal about 2 in 10 µ The inner plate of the valve is punctate as in *B favus* Diam. of v 72–125 µ.

Type locality Campeche Bay.

Distribution Marine Virgin Islands.

Illustrations Cleve, Bih Sv Vet-Akad. Handl. pl 5, f. 28; A Schmidt, Atlas, pl 78, f 18–20.

39 **Biddulphia antediluviana (Ehrenb.) Van Heurck, Syn. Diat Belg., 207 1885**
Amphitetras antediluviana Ehrenb, Ber Akad Berlin, 62 1839

Valves quadrangular, with sides slightly or deeply concave and round angles Processes large, very short and truncate, frequently unequal Surface with coarse, rounded, quadrate or hexagonal reticulations, smaller at the centre from which they radiate, forming concentric circles, about 3 in 10 µ, with thickened walls. Secondary layer punctate Ends of processes minutely punctate L of side 59–115 µ

Type locality Greece

Distribution Atlantic and Pacific Coasts

Illustrations Kütz, Bac pl 29, f 86, Brit Diat, 2 pl 44, f 318, A Schmidt, Atlas, pl 99, f 1–4, Van Heurck, Syn Diat. Belg, pl 109, f 4–5; Boyer, Diat of Philadelphia, pl 6, f. 3

40 **Biddulphia biquadrata (Janisch) Boyer Proc Acad Phila 53: 717 1901**
Triceratium biquadratum Janisch, A Schmidt, Atlas, pl 98.

Valves quadrangular, with slightly concave sides Angles rounded, with short, truncate processes Surface with coarse reticulations, about 2½ in 10 µ, the walls of which correspond partly to the meshes of a coarser network which is unequally but symmetrically distributed, producing the appearance of an inscribed square L of side 92–112 µ.

Type locality Yucatan

Distribution Marine Gulf of California

Illustrations A Schmidt, Atlas, pl 98, f 4–6

41 **Biddulphia pentacrinus (Ehrenb) Boyer, Proc Acad Phila, 53 717 1901**
Amphipentas pentacrinus Ehrenb, Ber. Akad Berlin, 10 1840.
Triceratium pentacrinus Wallich, Quart Jour Micr Sci, 6 249. 1858

Valves quadrangular or pentagonal, with concave sides Angles produced, with short, rounded processes. Surface nearly flat, with hexagonal reticulations, 5–7 in 10 µ, radiating from the centre. The walls of the reticulations being more robust in some parts than in others, there is produced a coarse network of various design extending over the entire surface Spines usually occur, one or more between the processes, nearer the border than the centre Zone with markings in quincunx. Diam 70–92 µ.

Type locality: Aegina.

Distribution Atlantic and Pacific coasts. Common in the Caribbean Sea.

Illustrations: Ehrenb, Mikrogeol., pl. 19, f. 59 (zone only); Wallich, Quart Jour. Micr. Sci., 6 pl 12, f. 10–14, A. Schmidt, Atlas, pl 98, f. 7–11.

42 **Biddulphia elegans** (Grev) Boyer, Proc. Acad Phila 53 717 1901

Amphitetras elegans Grev, Trans. Micr Soc. Lond, 14 9 1866.
Triceratium elegans (Grev) Grun, Van Heurck, Syn Diat Belg, pl 109. 1881.

Valves quadrangular, with sides slightly concave. Angles with short, cylindrical processes. Surface depressed at the centre, granulate, the granulations in radiating rows, about 5 in 10 µ, closer near the border Hyaline interspaces between the angles and the centre produce the appearance of an inscribed square. L. of side 60–90 µ.

Type locality Monterey, Cal, fossil deposit

Distribution Marine Campeche Bay

Illustrations Grev, Trans. Micr Soc. Lond, 14 pl 2, f 24; Van Heurck, Syn Diat Belg, pl 109, f. 1, A Schmidt, Atlas, pl. 99, f 10–13

43. **Biddulphia ornata** (Shadb.), forma *tetragona parva* (Grun)

Triceratium ornatum (Shadb), forma *tetragona parva* Grun, A. Schmidt, Atlas, pl 98 1886

Valves quadrangular, with concave sides and small, rounded processes Puncta radiating from the centre, 6 in 10 µ, interrupted by irregular, hyaline lines which traverse the valve obliquely in the direction of the processes and form an inscribed square distant from the sides. L of side 35 µ

Amphitetras ornata Shadb, from Port Natal, Trans Micr Soc., Lond, 2. 16. pl 1, f. 10 1854, is marked with more numerous hyaline lines It is probably to be considered, with the above, as a variation of *Biddulphia pentacrinus* (Ehrenb) Boyer.

Type locality: Campeche Bay

Distribution Marine Known only from the type locality.

Illustrations: A. Schmidt, Atlas, pl. 98, f. 18.

44. **Biddulphia tabellarium** (Brightw) Boyer, Proc. Acad. Phila., 53: 718. 1901.

Triceratium tabellarium Brightw., Quart Jour Micr Sci, 4. 275. 1856.
Triceratium venulosum Grev., Trans. Micr. Soc. Lond, 12 90. 1864.
Triceratium brevinervium Grev., Trans. Micr. Soc. Lond, 13: 101 1865.

Valves triangular, with straight or slightly convex sides and somewhat acute angles Angles slightly elevated. Numerous short costae extend inwards from the sides Surface slightly elevated at the centre, with a few scattered puncta which are more numerous on the angles. The angles are sometimes divided from the central part by costate lines L. of v. 60–160 µ.

Type locality Honduras

Distribution Marine Campeche Bay

Illustrations: Brightw, Quart Jour. Micr Sci, 4· pl. 17, f. 15; Grev., Trans. Micr Soc. Lond., 12· pl 13, f 21, 1864; pl. 9, f. 26. 1865

45 **Biddulphia alternans** (Bailey) Van Heurck, Syn. Diat. Belg., 208 1885.

Triceratium alternans Bailey, Smith Contr. 2 40. 1851.
Triceratium variabile Brightw, Quart Jour. Micr Sci 4· 275. 1856.

Valves triangular, occasionally quadrangular, with straight or somewhat unevenly concave sides Angles slightly elevated, rounded, separated from the central part by costate lines From the sides extend costae indefinite in length and direction. Surface with granules irregular at the centre, 5–6 in 10 µ, decreasing at the border to 8 in 10 µ, and in rows on the angles Zone narrow. Frustules frequently geminate L. of side 50 µ Variations occur with unequal sides and sometimes with more minute punctation

Type locality Atlantic Coast.

Distribution· Marine and brackish Aestuaries of the Atlantic coast. Rice fields of Georgia

Illustrations. Bailey, Amer Jour Sci, 48 pl 4, f 25 1845, Smith Contr 2^3 pl, f 55, 56, Brightw., Quart Jour Micr Sci. 4 pl 17, f 19; A Schmidt, Atlas, pl 78, f 9–17; Boyer, Diat Phila, pl 6, f. 7.

Biddulphia alternans tenuipunctata Mereschk, Polynesian Diatoms, (Scripta Botanica, Horti Universitatis Petropolitanae, Fasc 18, 27. pl 5, f 14, 1902) Puncta 8–10 in 10 µ L of side 40 µ Coast of California. Port Townsend Bay, Wash.

46 **Biddulphia trisulca** (Bailey) Boyer, Proc Acad Phila., 53 719 1901

Triceratium trisulcum Bailey, Pritchard, Infusoria, 854. 1861

Valves triangular, with concave sides and rounded angles which are elevated into large, globose processes and separated by hyaline apparent costae Surface convex, with a few unequal, rounded granules in the centre, smaller and closer, somewhat angular on the processes, 4–6 in 10 µ. L of side 125–150 µ.

Type locality: West Indies.

Distribution Marine. Campeche Bay.

Illustrations A Schmidt, Atlas, pl. 78, f 5–8, pl 112, f 17, 18, Pritchard, Infusoria, pl. 8, f 27

47 **Biddulphia antillarum (Cleve) Boyer, Proc. Acad Phila. 53: 723 1901**

Triceratium antillarum Cleve, Bih Sv. Vet-Akad. Handl 5^{8}. 16. 1878.

Valves four or five angled, with concave sides. Angles produced, obtuse. Surface slightly convex, with rounded granules, 6–8 in 10 µ, somewhat concentric at the centre, radiating toward the processes. Diam. 90–115 µ

Type locality. Virgin Islands

Distribution Marine. Campeche Bay.

Illustrations Cleve, Bih Sv Vet-Akad Handl. 5^{8} pl 5, f 29; A Schmidt, Atlas, pl 99, f. 14

48 **Biddulphia reticulum (Ehrenb) Boyer, Proc Acad Phila., 53 724. 1901**

Triceratium reticulum Ehrenb, Ber Akad Berlin, 27 1843.
Triceratium sculptum Shadb, Trans. Micr Soc Lond 2: 15. 1854
Triceratium punctatum Brightw, Quart Jour Micr Sci 4: 275. 1856

Valves triangular or polygonal, with straight or slightly concave sides Angles rounded, sometimes produced. Surface slightly elevated at the centre and angles Puncta 4–5 in 10 µ, irregular and unequal, smaller at the angles Groups of puncta sometimes occur arranged in three or four circles L of side usually about 50 µ

Type locality Richmond, Va., fossil deposit.

Distribution Marine and brackish Common in aestuaries

Illustrations Ehrenb, Mikrogeol, pl 18, f 50, pl 33, 16, f 13, Shadb, Trans Micr. Soc Lond. 2: pl 1, f 4; Brightw, Quart. Jour. Micr Sci 4 pl 17, f 18, A Schmidt, Atlas, pl 76, f 4, 9–12, 19, 20, Van Heurck, Syn Diat Belg, pl 109, f 7, 8, Boyer, Diat Phila, pl. 6, f. 5

49. **Biddulphia Jucatensis (Grun.) Boyer**

Triceratium jucatense Grun., A. Schmidt, Atlas, pl 76 1882.

Valves triangular, with straight sides and rounded angles Surface with rounded, irregular and scattered puncta, 2–3 in 10 µ. Angles slightly elevated, with puncta 8–10 in 10 µ, indistinct. L. of side 90 µ. This may be a variety of *Triceratium elegans* Grev.

Type locality Campeche Bay.

Distribution Marine. Known only from the type locality

Illustrations. A Schmidt, Atlas, pl 76, f. 13.

50 **Biddulphia parvula (Janisch & Rab.) Boyer, Proc. Acad. Phila., 53 725. 1901**

Amphitetras parvula Janisch & Rab, Beitr. Alg 1: 4. 1863.
Triceratium zonatulatum Grev., Trans Micr Soc. Lond. 13: 102. 1865.

Valves quadrangular, with deeply concave sides producing a cruciform outline. Angles rounded, slightly elevated. Surface with minute puncta concentric around an indistinct nodular centre and in parallel rows on the angles, about 10 in 10 µ. The space between central part and the angles is hyaline. Diam. of v. to 38 µ.

Type locality. Honduras

Distribution Known in N America from the type locality only

Illustrations Janisch & Rab , Beitr. Alg pl. 1, f. 4, Grev , Trans. Micr. Soc. Lond. 13· pl 9, f 17, A. Schmidt, Atlas, pl. 77, f 34

Species Reported or Unclassified

Cerataulus petiti Leud Ann Jard Bot Buitenz 11: 39 1892

Valves elliptical, convex Processes inflated at the base, placed obliquely opposite A row of spines on the border. Surface finely punctate, covered with short spines at irregular intervals L of major axis 170 μ Apparently near *Biddulphia californica* (A Schmidt) Boyer, Proc Acad Phila 53 711 1901

Type locality· Java

Distribution Marine St Croix St Thomas (Oestrup).

Illustrations Leud , Ann Jard. Bot Buitenz. 11 pl 6, f. 3

Triceratium radiolatum Janisch, A Schmidt, Atlas pl 151

Valves triangular, with rounded angles From near the centre puncta, 9 in 10 μ, radiate in somewhat curved, fasciculate rows, slightly decreasing to the border, the rows parallel to those in the middle. The hyaline interspaces between the fasciculi form apparent radiating lines L of side 55 μ This form is not Biddulphoid and is similar in markings to *Coscinodiscus* from which it differs in outline only It may be proper to place it under *Pseudotriceratium* In some specimens minute apiculi occur within the border.

Type locality ? Gazelle Expedition.

Distribution Marine Gulf of California

Illustrations A Schmidt, Atlas, pl 151, f. 37, 38

Triceratium heterostictum A. Schmidt, Atlas, pl 151, f 28, is an undescribed form from Campeche Bay It is coscinodiscoid in structure and ascribed to *Cestodiscus cinnamomeus* Grun.

Triceratium coscinoides Grove & Stuart, Jour Quek Club II 2. 327. pl 19, f. 13. 1886. *Trigonium coscinoides* (Gr. & St) Mann, Contr. U. S. Nat. Herb 10³: 292 1907. Valves triangular, with straight or slightly concave sides and subobtuse angles. Markings hexagonal cells, about 5 in 10 μ at the centre and decreasing to the border L. of side 48–160 μ (acc to Mann) Behring Sea (Mann). This appears to be a triangular form of *Coscinodiscus* and occurs fossil in the Oamaru, N. Z., deposit and in the deposits of Nottingham, Md , and Barbados.

34. ISTHMIA Ag., Consp Crit Diat., 55 1832

Frustules rhomboidal or trapezoidal, asymmetrical to the longitudinal axis, stipitate, epiphytic or parasitic. Valves dissimilar, elliptical or ovate, convex, the end of one valve elevated into a protuberance or beak attached to the stipe, the other valve rising in a gradual elevation toward one end. Zone well developed, frequently persistent and enclosing young frustules. Chromatophores rounded granules on the walls of the cell.

Type species, *Isthmia obliquata* (Lyngb.) Ag

Valves with costae converging from the margin.	1 *I. nervosa*
Valves without costae, equal.	2. *I. enervis*
Valves without costae, unequal.	3. *I. minima*

1 **Isthmia nervosa** Kütz., Bac 137 1844

Diatoma obliquatum Lyngb., Tent. Hydroph. Dan., 181 1819
Isthmia obliquata (Lyngb.) Ag., Consp Crit Diat., 55 1832

Valves with costae from 10–50, converging from the margin, elliptical or ovate, with rounded cells about 3 in 10 µ. Zone well developed, with large cells on its border On one valve the small cells of the beak attached to the stipe are about 5 in 10 µ. L of frustule about 264 µ. L of v 198 µ

Type locality North Atlantic.

Distribution Marine Atlantic and Pacific Oceans

Illustrations Kütz., Bac pl 19 f 5, W. Smith, Syn Brit. Diat., 2. pl 47, A Schmidt, Atlas, pl. 135, f 1–6, J D Cox, Amer. Jour. Micr., 3. 97, 125 1878.

2 **Isthmia enervis** Ehrenb., Inf., 209 1838

Conferva obliquata J E Smith, Eng Bot pl 1889 1814
Isthmiella enervis (Ehrenb.) Cleve, Bih Sv Vet.-Akad Handl 1^{18} 10. 1873

Valves without costae Cells of the beaks not so small as in *I. nervosa*, while the cells of the zones are smaller than those of the valves. Frustules usually elongated and smaller, otherwise as in *I. nervosa*.

Type locality. North Atlantic.

Distribution Marine Honduras

Illustrations W Smith, Syn. Brit. Diat., 2: pl. 48, Pritchard, Infusoria, pl. 10, f 183, Van Heurck, Syn Diat. Belg., pl 96, f. 1–3; A. Schmidt, Atlas, pl 136, f 1, 3, 6, 7.

In a note to "Biddulphoid Forms" in Proc. Acad Phila., 53: 689. 1901; it is stated that "the figure given by J. E. Smith in English Botany, plate 1889, under the name *Conferva obliquata* is undoubtedly *I. enervis* as it does not show the costae." As, however, the original name has been variously applied to forms with and forms without costae by different authors the names given by Ehrenberb and Kützing are here retained.

3 **Isthmia minima Harv. & Bail , U S. Expl Exp. 17: 176 1862**
Isthmia lindigiana Grun & Eul., Hedwigia, 29. 1867
Isthmia capensis Grun , A. Schmidt, Atlas, pl 136

Frustules smaller and more elongated than in *I. nervosa* and *I enervis* Valves unequal, one usually having ridged elevations. Cells of the valves 1½ in 10 μ and 3 in 10 μ on the connective zone. Secondary markings minute puncta in longitudinal rows within the reticulations

Type locality Barbadoes deposit

Distribution · Marine Campeche Bay Honduras

Illustrations Harv & Bail U. S Expl. Exp 17. Algae pl 9, f 11; A Schmidt, Atlas, pl 136, f 4, pl. 145, f 1–4, 9

35 **HEMIAULUS Ehrenb Ber Akad Berlin, 199 1844. Em Heiberg Consp. Diat , 22 1863**

Frustules quadrate, compressed, free or in short filaments Valves elliptical, frequently septate or apparently so, with angles produced into processes or horns tipped with a spine Surface coarsely cellular or punctate

Type species, *Hemiaulus polycistinorum* Ehrenb

Valves elliptical, not septate, with long horns	1 *H kittonii*
Valves elliptical, septate, with short horns	2 *H bipons*
Valves lanceolate, with a longitudinal keel	3. *H polycistinorum*

1 **Hemiaulus kittonii Grun , Van Heurck, Syn. Diat Belg., pl 106. 1881**
Hemiaulus ? sp Kitton, Jour Quek. Club, 2 171 1870

Valves elliptical, not septate, with long horns, 50 μ in length, having a spine at each apex and one below it. Surface, including horns, punctate, the puncta about 10–15 in 10 μ, irregular on the valve, parallel on the processes. L. of v. 16–19 μ Spores globular

Type locality Jutland fossil deposit

Distribution. Marine Vera Cruz. Rare.

Illustrations Kitton, Jour. Quek Club, 2. pl 14, f. 11, Van Heurck, Syn Diat Belg., pl 106, f 6–9, A. Schmidt, Atlas, pl. 142, f. 4.

2 **Hemiaulus bipons (Ehrenb.) Grun., Denks. Akad Wien. 48 13. 1884**
Zygoceros ? bipons Ehrenb., Ber. Akad. Berlin, 273 1844.

Valves elliptical, concave, with short horns tipped with a spine, divided transversely by two septa. Surface coarsely cellular or granulate, the cells 4–5 in 10 μ. L. of v. 35 μ.

Type locality · Nottingham deposit.

Distribution · Marine. Arctic Sea. Salem and Dorchester, Mass. (in post glacial deposit).

Illustrations · Van Heurck, Syn. Diat. Belg., pl. 103, f. 6–9.

3. **Hemiaulus polycistinorum Ehrenb., Mikrogeol., pl 36. 1854.**

Valves lanceolate, concave, with a narrow, longitudinal keel on the surface and with strong horns variable in length, tipped with a stout spine Surface with coarse granules, prominent on the horns L. of v. to 125 µ L of horns to 84 µ or more Quite variable

Type locality Barbadoes deposit

Distribution. Occurs in dredgings and may be of fossil origin.

Illustrations Ehrenb., Mikrogeol, pl 36, f. 43; A Schmidt, Atlas, pl 143, f 23–29

The above three species are all of rare occurrence and are admitted here with some hesitation as forms extant on the coast

36 TRINACRIA Heiberg Consp Diat., 49. 1863

Valves triangular, with more or less concave sides Angles with elevated processes usually tipped with a mucron or spines Surface punctate Resembles *Hemiaulus* except in outline.

Type species, *Trinacria regina* Heib

1 **Trinacria pileolus (Ehrenb) Grun, Denks Akad Wien. 48 16. 1884.**

Triceratium pileolus Ehrenb, Ber Akad Berlin, 205 1844.

Valves triangular Surface with scattered puncta smaller in the centre Margin with a row of large cells about 3 in 10 µ Angles usually unequally elevated, with scattered puncta, sometimes tipped with small spines L of side to 105 µ.

Type locality Simbirsk, Russia (fossil)

Distribution Marine Barden Bay, Greenland Port Antonio, Jamaica

Illustrations Ehrenb, Mikrogeol, pl. 35, 21, f 17, Grun., Denks Akad Wien 48 pl 2, f 59, 60; A Schmidt, Atlas, pl 97, f. 11–14; Boyer, Diat Philadelphia, pl. 6, f 9

7 Anauleae

1 *Anaulus* Valves elliptical, divided into three parts by septa

2. *Eunotogramma*. Valves lunate, divided by two or more, sometimes numerous septa.

3. *Huttonia*. Valves elliptical, with a truncate process at one end.

4 *Terpsinoë*. Valves elliptical or triangular, with undulating sides, septate, the septa sometimes curved at the ends, prominent in zone view. Puncta irregular.

5. *Porpeia* Valves rounded at the ends, inflated in the middle, septate. Puncta scattered.

37 **ANAULUS** Ehrenb, Ber Akad Berlin, 197 1844. Em Grun, in Van Heurck, Syn. Diat. Belg, pl 102 1881

Frustules quadrate Valves elliptical, divided by septa into three parts. Surface slightly convex, punctate

Type species, *Anaulus birostratus* Grun

Septa straight.	1 *A. birostratus*
Septa curved	2 *A. minutus*

1 **Anaulus birostratus** Grun, Van Heurck, Syn. Diat Belg pl 22 bis. 1881

Biddulphia birostrata Grun, Verh Zool-Bot Ges Wien 13 158 1863

Valves elliptical-lanceolate, sometimes constricted at the ends Central part quadrate Puncta scattered, about 4 in 10 µ, more evident at the centre, at which a nodule is usually apparent L of v. 94–105 µ

Type locality Coast of Peru

Distribution Marine Virgin Islands

Illustrations Grun, Verh Zool-Bot Ges Wien 13 pl 4, f. 23, Van Heurck, Syn Diat Belg, pl 22 bis, f 15, pl. 103, f 1–3.

2 **Anaulus minutus** Grun Van Heurck Syn Diat Belg, pl 103 1881

Frustule with curved, capitate septa Valves elliptical Transverse septa two, dividing the surface into three equal parts Striae subtle, about 25 in 10 µ L of v 17 µ

Type locality Seychelle Islands

Distribution Marine Bahamas Not common

Illustrations Van Heurck, Syn Diat Belg, pl 103, f. 4, 5

38 **EUNOTOGRAMMA** J F Weisse Bull. Phy Math Acad St Pétersb, 13 243 1854.

Frustules quadrangular, with sharp angles Valves lunate, divded into two or more septa Puncta usually in transversé lines

Type species, *Eunotogramma triloculatum* J F Weisse.

1 **Eunotogramma leve** Grun., Van Heurck Syn. Diat Belg. pl 126. 1881

Valves lunate, flat, obtuse Septa 2–8 or more, usually from 4–6 Surface with indistinct puncta, scattered, 10 in 10 µ. L of v 35 µ.

Type locality Florida

Distribution Marine. Atlantic coast.

Illustrations. J F. Weisse, Bull Phy. Math Acad St. Pétersb. 13 pl 3, f 37, Leud, Mém Soc. Emul Côtes du Nord, pl 9, f 93–95. 1879; Van Heurck, Syn Diat. Belg, pl 125, f 6, 7, 9, 15; Boyer, Diat Philadelphia, pl. 7, f. 11

2. **Eunotogramma debile** Grun., Van Heurck, Syn. Diat. Belg, pl 126. 1881

Valves more slender than in *E. leve* and with more numerous septa Puncta in transverse rows about 15 in 10 µ.

Type locality Campeche Bay

Distribution Coast of South Carolina

Illustrations Van Heurck, Syn. Diat Belg., pl 126, f. 17–19.

As intermediate forms occur between the two species it may be proper to unite them under *E leve.*

39. **HUTTONIA** Grove and Sturt Jour Quek. Club, Ser 2, 3: 142 1887

Frustules quadrangular, solitary or geminate, rounded at the angles. Valves with two septa extending a short distance within, elliptical, with a short, truncate process, as in *Cerataulus*, extending obliquely at one end on opposite sides Surface punctate.

Type species, *Huttonia alternans* Grove and Sturt.

1 **Huttonia reichardtii** Grun., Just's Bot. Jahresb., 279. 1887

Cerataulus ? Reichardtii Grun, Verh. Zool.-Bot Ges. Wien, 13. 158 1863

Valves elliptical, with narrow, oblique or curved septa Surface punctate, the puncta in irregular, transverse and longitudinal rows, 8–10 in 10 μ. L of v. 40–50 μ.

Type locality Adriatic Sea.

Distribution: Marine Virgin Islands. Caribbean Sea.

Illustrations: Grun, Verh Zool-Bot Ges. Wien 13: pl. 4, f 22; A Schmidt, Atlas, pl 116, f. 4

40. **TERPSINOË** Ehrenb Abh Akad Berlin, 402 1841

Frustules quadrangular, concatenate or free Valves elliptical or triangular, constricted, or with undulating sides, septate, the septa prominent in zone view, either straight or curved at the ends Surface punctate, sometimes reticulate.

Type species, *Terpsinoë musica* Ehrenb.

Septa with inner margins curved and thickened Surface with coarse puncta. Valves elliptical, divided into three or more parts	1 *T. musica*
Septa bent near the edge. Surface punctate and reticulate.	2 *T. intermedia*
Septa capitate, not curved Surface punctate. Valves divided into five segments	3 *T. brebissonii*
Septa extending half way into the valves. Surface with coarse, indistinct puncta. Valves lobed at each end, inflated in the middle.	4. *T. americana*
Septa short. Valves small.	5. *T. minima*

1. **Terpsinoe musica** Ehrenb., Abh. Akad. Berlin. pl. 3. 1843.

Frustules quadrangular, the septa with their inner margins curved and thickened, appearing like musical notes. Valves elliptical, with undulating sides, lobed at the ends, divided by septa into three or more parts. Surface with coarse puncta about 8 in 10 μ, finer at the ends A central nodule is usually evident Puncta on the connective zone about 12 in 10 µ L of v. 150 µ

Type locality West Indies.

Distribution Marine, brackish and fresh water Atlantic coast, southward Texas. Bermuda. Martinique Jamaica

Illustrations Ehrenb, Abh Akad Berlin pl 3, f 4, Mikrogeol, pl 34, 6, A, f 8, A Schmidt, Atlas, pl. 199, f 9–13, pl. 200, f. 7, 8, Pritchard, Infusoria, pl 11, f. 47

2 **Terpsinoe intermedia** Grun., Denks. Akad Wien 48 59 1884.

Valves as in *T. musica* but with surface punctate and reticulated, the reticulations irregular and unequal, 2–3 in 10 µ Septa bent near the edge L. of v 174 µ

Type locality Sierra Leone

Distribution Marine Mobile, Ala.

Illustrations A Schmidt, Atlas, pl. 198, f 65, pl 199, f 1–8, pl 200, f 1–6

3 **Terpsinoe brebissonii** (Kütz) Van Heurck, Treat. Diat., 453. 1896.

Pleurodesmium brebissonii Kütz, Bot Zeit, 248. 1846.

Valves elliptical, with undulating sides divided by septa into five segments, punctate, the puncta 6 in 10 µ Frustules quadrangular, with septa capitate but not curved Connective zone with puncta about 15 in 10 µ L of v 66 µ

Type locality. Guiana

Distribution Marine. Cedar Keys, Fla

Illustrations Pritchard, Infusoria, pl 6, f. 23, A Schmidt, Atlas, pl 200, f 15–19, H L Smith, T S. 388

4 **Terpinsoe americana** (Bailey) Ralfs, Pritchard, Infusoria, 859. 1861

Tetragramma americana Bailey, Smith Contr 7 7. 1853

Frustules quadrangular, with septa extending about half way into the valve Valves with undulating outline, lobed at each end and inflated in the middle, divided by septa into three or more segments Surface with coarse but indistinct puncta, about 6 in 10 µ. L of v. 59 µ.

Type locality Tampa Bay, Fla.

Distribution Marine, brackish and fresh water. Hudson River. Rockaway, L I. Charleston, S C St. Augustine, Fla

Illustrations: Bailey, Smith. Contr. 7: f. 1, A Schmidt, Atlas, pl. 200, f. 9–13, Boyer, Diat. Philadelphia, pl. 6, f. 10.

5. **Terpsinoe minima** Bailey, Bost. Jour Nat. Hist. 7 340. 1862

Frustules quadrangular. Valves divided into three parts by septa. In zone view the two septa at each end are short. (L. W. Bailey).

The form is insufficiently described and figured

Type locality. Pará River, Brazil.

Distribution· Marine. Somesville, Maine (A. B. Aubert)?

Illustrations L. W Bailey, Bost Jour Nat. Hist. 7. pl 7, f 54

The above form listed by Prof. Aubert in Le Diatomiste 2. 142 (as *T minuta*, in error) is admitted with hesitation as I have been unable to find it in the original material.

41 **PORPEIA Bailey, Ralfs, Pritchard, Infusoria, 850. 1861**

Frustules compressed, quadrangular, with angles more or less elevated into globular projections separated by deep septa which extend inward toward the centre in curved lines Valves oblong, inflated in the middle and at the ends which are separated by septa. Markings punctate, scattered in the middle part, closer at the ends.

Type species, *Porpeia quadriceps* Bail

1. **Porpeia quadriceps Bailey in Ralfs, Pritchard, Infusoria, 850 1861**

Valves rounded at both ends, inflated in the middle At the junction of each process with the valve a septum extends inward, curving and becoming parallel to the zone toward the centre. Puncta scattered on the surface of the valve, about 6 in 10 µ on the processes and in parallel rows on the connective zone L of v. 29–136 µ.

Numerous forms in Campeche Bay approach *P quadrata* Grev., Trans. Micr Soc. Lond , 13. 53, 1865, pl. 6, f 20, in which the processes are scarcely elevated and the septa extend in lines parallel to the zone

Type locality "Gulf Stream "

Distribution Campeche Bay Gulf of Mexico

Illustrations· Pritchard, Infusoria, pl. 6, f. 6, Grev., Trans Micr. Soc Lond , 13 pl. 6, f 18, 19 1865; Van Heurck, Syn. Diat Belg , pl 95 bis, f 14

B PENNATAE

Transverse section of the frustule usually more or less elliptical or quadrate Chromatophores may be either placcochromatic or coccochromatic. Forms with a true raphe, not epiphytic or sessile, are more or less motile.

Divided into three groups.

1. Fragilariatae. Valves without a raphe, usually with a pseudoraphe or median line
2. Naviculatae. Either one or both valves with a true raphe.
3. Surirellatae Valves in which the raphe is concealed near the margin on one or both sides in a more or less elevated keel or wing.

IV. FRAGILARIATAE

The Fragilariatae are divided into three sections

Tabellarieae. Valves symmetrical with respect to both the longitudinal and transverse axes; septate, not cuneate.

Meridioneae. Valves symmetrical with respect to the longitudinal axis, asymmetrical to the transverse axis; cuneate.

Fragilarieae. Valves of varied outline, not cuneate, costate or with transverse rows of puncta

8 Tabellarieae

(a) Tabellariinae	Frustules septate	Valves alike
(b) Entopylinae	Frustules septate	Valves arcuate, unlike.

(a) TABELLARIINAE

Frustules in zone view rectangular, in valve view linear or linear-elliptical, sometimes constricted in the middle, symmetrical to both axes, not cuneate, with two or more septa. Chromatophores numerous, granular

1. *Rhabdonema* Frustules with numerous septate partitions having one or several foramina Transverse costae or rows of coarse puncta

2 *Tabellaria* Frustules with from two to six nearly straight septa Transverse striae subtly punctate.

3 *Diatomella* Frustules with two straight, perforate septa. Striae finely punctate

4. *Grammatophora* Frustules with two sinuate, perforate, curved septa Transverse striae subtly punctate.

5. *Striatella*. Frustules with alternate partitions, septate or partly so

42 RHABDONEMA Kütz. Bac. 126 1844

Frustules concatenate in filaments, quadrangular, composed of numerous septate partitions, with transverse costae or rows of puncta. Valves elliptical or linear-lanceolate, with a pseudoraphe and transverse apparent costae and punctate lines Partitions with one or more foramina Chromatophores in rosettes of various kinds, usually parallel to the septa A pyrenoid occurs in each chromatophore.

Type species, *Rhabdonema minutum* Kütz.

Foramen single, central.	
Valves lanceolate-elliptical Septate divisions in zone view alternating with single rows of puncta	1 *R. arcuatum*
Valves elliptical, gibbous in the middle. Costae coarse, irregular	2. *R. torellii*

Valves oblong-linear Costae alternating with alveoli	3 *R. robustum*
Valves elliptical-lanceolate, tumid in the middle Costae alternating with rows of puncta	4 *R crozierii*
Valves oblong, with concave sides Septate divisions divided into quadrangular cells.	5 *R. subrostratum*
Valves elliptical, sometimes turgid in the middle Septate divisions divided into quadrangular cells	6 *R ehrenbergii*
Foramen single, alternate Valves elliptic-lanceolate.	7 *R. minutum*
Foramina three. Valves linear-lanceolate	8 *R. adriaticum*
Foramina numerous Valves linear	9 *R punctatum*

1 **Rhabdonema arcuatum (Lyngb.) Kütz., Bac., 126. 1844**

Diatoma arcuatum Lyngb., Tent Hydrophyt Dan., 180 1819

Valves lanceolate-elliptical, with transverse costae reaching the pseudoraphe, 8 in 10 µ, alternating with single rows of puncta about 10 in 10 µ Foramen single, large In zone view the hyaline angles are rounded, the septate divisions with transverse costae alternating with single rows of puncta as in valve view L of v. usually about 95 µ, but quite variable

Type locality Denmark.

Distribution Marine Atlantic and Pacific Coasts

Illustrations Lyngb., Tent Hydrophyt. Dan., pl. 62, f. B; Kütz., Bac., pl 18, f. 6, W. Smith, Syn Brit. Diat. 2: pl. 38, f 305, A Schmidt, Atlas, pl 220, f 17–22, Boyer, Diat Phila., pl 8, f. 1–3

Rhabdonema arcuatum ventricosum Cleve, Bih. Sv. Vet-Akad Handl 1^{18} 24 pl 4, f. 21 1873 A small form, 25–50 µ in length, with gibbous sides and striae 10 in 10 µ. Greenland Davis Strait

2 **Rhabdonema torellii Cleve, Bih Sv Vet.-Akad Handl 1^{18} 24. 1873**

Valves elliptical, gibbous in the middle Costae coarse, 2–3 in 10 µ, united in the middle, sometimes irregular. Zone view quadrangular, divided by numerous costae. Striae 9–10 in 10 µ. Foramen large L. of v. 96–140 µ (Cleve.)

Type locality Greenland.

Distribution Marine Known only from the type locality Rare.

Illustrations Cleve, Bih. Sv. Vet.-Akad Handl. 1^{18}: pl. 4, f. 20; A. Schmidt, Atlas, pl. 218, f. 18–20 (?).

Rhabdonema torellii regularis Oestr., Meddelelser om Groenland, 18 454 pl 8, f 98 1895. Costae more regular than in the type, 5 in 10 µ Striae 12 in 10 µ. L of v. 50 µ Greenland. (Oestr)

3 **Rhabdonema robustum** Grun., Verh Zool.-Bot Ges. Wien 12 108 1862

Valves oblong-linear, broad Costae 1½–2½ in 10 µ, reaching the undulating pseudoraphe, alternating with single rows of alveoli. Frustules in zone view with rounded, hyaline angles, the septate divisions alternating with oblong areolæ about 4 in 10 µ Foramen large L of v. 120–220 µ (Grun)

Type locality North Pacific Ocean

Distribution Marine Known only from the type locality

Illustrations Grun Verh Zool -Bot Ges Wien 12 pl 5 (8), f 1, A Schmidt, Atlas, pl 217, f 30–32

4 **Rhabdonema crozierii** (Ehrenb ?) Fricke, in A Schmidt Atlas, pl 220 1900

Striatella crozierii Ehrenb , Mikrogeol , pl 35, A, 33, f 14–16?
Rhabdonema crozierii (Ehrenb) Grun , Verh Zool -Bot Ges Wien 12 109 1862?

Valves elliptical-lanceolate, tumid in the middle Costae 5–6 in 10 µ, alternating with single rows of puncta Frustule in zone view with hyaline, rounded angles, the septate divisions alternating with single rows of puncta Foramen large L of v 75 µ Variable in outline and size

Type locality Assistance Bay (Ehrenb)?

Distribution Marine Pacific Coast

Illustrations A Schmidt, Atlas, pl 220, f 4–9

Ehrenberg's figure apparently does not represent this form, and, as there is much confusion in the identification of the species, the only references to illustrations are to those in the "Atlas" which are exact figures of forms common on the California coast and northward

5. **Rhabdonema subrostratum** Fricke in A Schmidt Atlas, pl 221 1900

Rhabdonema robustum Grun , in Mereschk , Polynesian Diatoms, (Scripta Botanica, Universitatis Petropolitanae, Fasc. 18, 26. pl 6, f 10 1902?) Apparently not Grunow's form in which the costae are stated to be 1½–2½ in 10 µ

Valves oblong, with concave sides and cuneate or subrostrate ends Costae transverse, reaching the pseudoraphe, about 8 in 10 µ, alternating with single rows of puncta about 8 in 10 µ. Foramen single, large In zone view the hyaline angles are rounded and the septate divisions are divided into quadrangular cells 4–5 in 10 µ L of v 90 µ The zone view resembles *R ehrenbergii* while the valve view approaches *R biquadratum* Brun.

Type locality Long Island Sound

Distribution Marine Pacific Coast

Illustrations A Schmidt, Atlas, pl 220, f 30–32, pl. 221, f 2–8

Rhabdonema subrostratum parallelolaterale Fricke, in A. Schmidt, Atlas, pl. 220, f. 27–29 1900. Valves linear, slightly constricted in the middle, with rounded, subcuneate ends. Striae 7 in 10 μ, coarsely punctate. Port Townsend, Wash

6 **Rhabdonema ehrenbergii Fricke, in A. Schmidt. Atlas, pl. 220. 1900.**

Rhabdonema cromerii Ralfs, in Pritchard, Infusoria, 805 1861. This form is sometimes referred to *R crozierii* (Ehrenb) Grun from which it differs in zone view

Valves elliptical, the smaller ones turgid in the middle, with transverse costae reaching the pseudoraphe, alternating with single rows of puncta, 8 in 10 μ. Foramen single, large. In zone view the frustules are rounded at the hyaline angles and the septate divisions are divided into quadrangular cells, 4–5 in 10 μ L of v. about 60 μ

Type locality Coast of California.

Distribution · Marine Pacific Coast Common

Illustrations Pritchard, Infusoria, pl 4, f. 43, A Schmidt, Atlas, pl 220, f 12–16; H L Smith, T S 434

7 **Rhabdonema minutum Kütz., Bac., 126 1844.**

Valves elliptic-lanceolate, with transverse striae, 8–10 in 10 μ, punctate, the puncta about 16 in 10 μ. Foramen single, the septum alternating above and below in adjoining partitions In zone view the angles are rounded but not hyaline. L of v. about 25 μ

Type locality North Sea.

Distribution Marine. Arctic and Atlantic Oceans

Illustrations Kütz, Bac pl 21, f 2, 4, W. Smith, Syn. Brit. Diat 2 pl 38, f 306, Pritchard, Infusoria, pl. 4, f 41, Van Heurck, Syn. Diat Belg., pl 54, f 17–21, Boyer, Diat Phila, pl 8, f 7, pl. 38, f 11, H L Smith, T S 435

8 **Rhabdonema adriaticum Kütz., Bac, 126 1844.**

Valves linear-lanceolate, with transverse striae 8 in 10 μ, punctate, the puncta about 15 in 10 μ Foramina three, the septa curved and somewhat thickened at the ends. In zone view the angles are hyaline, rounded or obliquely truncate L. of v. about 95 μ.

Type locality Adriatic Sea.

Distribution Marine. Atlantic and Pacific Coasts.

Illustrations · Kütz., Bac., pl. 18, f. 7; Pritchard, Infusoria, pl. 13, f. 27; W. Smith, Syn Brit. Diat. 2: pl. 38, f. 305; Van Heurck, Syn. Diat. Belg., pl 54, f. 11–13; A. Schmidt, Atlas, pl. 217, f. 17–26; Boyer, Diat. Phila., pl. 8, f. 4–6.

9. **Rhabdonema punctatum (Harv & Bail.) Stodder, Amer Mo. Micr. Jour 1: 114. 1880.**

Hyalosira punctata Harv & Bail, Proc Acad. Phila 6. 430 1853.
Rhabdonema mirificum W. Smith, Syn. Brit Diat 2 35. 1856.
Striatella? punctata Harv & Bail., U S Expl Exp. 17. 181. 1862.

Valves linear, transversely striate, the striae 10–12 in 10 μ, punctate, the puncta about 15 in 10 μ. Foramina very numerous, irregular. In zone view the angles are rounded and hyaline, the partitions alternately interrupted in the middle L of v about 100 μ or more.

Type locality. Tahiti

Distribution Marine Honduras. Pacific Ocean.

Illustrations· Brightw, Quart Jour. Micr Sci 7. pl. 9, f. 11; Harv & Bail, U S Expl. Exp 17· Algae, pl. 9, f 29, 30, Grun, Verh. Zool-Bot. Ges Wien 12 pl 6 (9), f 3, Janisch & Rab in Rab. Beitr. Alg. 1 pl 2, f 19, A. Schmidt, Atlas, pl. 217, f 1–3; Pritchard, Infusoria, pl. 8, f 12

43 TABELLARIA Ehrenb, Ber Akad. Berlin, 217 1840

Frustules quadrangular, adnate in filaments, frequently found in zigzag chains, at length separating Septa straight or nearly so, short or extending nearly to the centre, sometimes alternating. Valves linear or oblong, inflated in the middle and at each end or panduriform Pseudoraphe narrow Striae transverse, punctate. Chromatophores numerous, rounded, small, along the zone

Type species, *Diatoma fenestratum* Lyngb

Frustules linear-oblong, with two straight septa at the ends.	1. *T fenestrata*
Frustules quadrangular, with from 4–8 septa, alternating.	2 *T flocculosa*
Frustules quadrangular, with from 4–8 short, alternating septa. Valves panduriform.	3. *T. binalis*

1 Tabellaria fenestrata (Lyngb.) Kütz., Bac., 127 1844.

Diatoma fenestratum Lyngb, Tent Hydrophyt Dan, 180 1819
Tabellaria trinodis Ehrenb, Ber Akad Berlin, 251 1840

Frustules linear-oblong, with two straight septa at each end. Valves linear, elongated, inflated in the middle and at the ends. Pseudoraphe narrow, widened in the middle. Transverse striae punctate, the puncta 10 in 10 μ L of v. to 100 μ.

Type locality. Norway.

Distribution. Fresh water. Common in streams and ponds, especially in cedar swamps. Plankton of Lake Erie (Coll. L. A. Tiffany).

Illustrations: Lyngb., Tent. Hydrophyt. Dan., pl. 61, E, f. 3, Kütz, Bac., pl. 17, f. 22, pl. 18, f. 2, pl. 30, f. 73; Ehrenb., Mikrogeol., pl. 33, 2, f. 19, pl. 38, 17, f. 21, 22; W. Smith, Syn. Brit. Diat. 2: pl. 43, f. 317; Brun, Diat. Alpes, pl. 9, f. 13; Boyer, Diat. Phila., pl. 8, f. 11, 12.

Tabellaria fenestrata intermedia Grun., in Van Heurck, Syn.

Diat. Belg., pl. 52, f. 6–8. 1881. Valves with more than two septa at each end Approaches *T. flocculosa* May occur with type

2 **Tabellaria flocculosa** (Roth) Kütz, Bac, 127 1844.
Conferva flocculosa Roth, Catalecta Botanica, 1 192 1797
Diatoma flocculosum Lyngb, Tent Hydrophyt Dan, 179 1819

Frustules quadrangular, with from 4–8 septa, somewhat incurved at each end, alternating with those at the opposite end Valves linear, with median inflation larger than the terminal Pseudoraphe broad in the middle Transverse striae subtly punctate, the puncta 13 in 10 µ L of v to 40 µ

Type locality Europe.

Distribution Fresh water Common in streams, ponds and cedar swamps

Illustrations Dillwyn, Brit Conf, pl 28, Lyngb, Tent Hydrophyt Dan, pl 61, B, f 4, W Smith, Syn Brit Diat, 2 pl 43, f. 316, Van Heurck, Syn Diat Belg, pl 52, f 10–12, Boyer, Diat. Phila, pl 8, f 8–10

Tabellaria flocculosa ventricosa (Kütz) Grun, Verh. Zool-Bot. Ges Wien 12 410 1862 *Tabellaria ventricosa* Kütz, Bac, pl. 30, pl 30, f 74 Median inflation much greater than the terminal. Local Fall Mt, Conn Terry, in Rhodora 10 183 1908

3 **Tabellaria binalis** (Ehrenb ?) Grun. in Van Heurck, Syn Diat. Belg pl 44. 1881
Fragilaria binalis Ehrenb ? Mikrogeol, pl 3, f 9 (?) 1854
"*Tetracyclus*" (abnormal) ? Lewis, Proc Acad Phila 17 15 1865

Frustules in short fasciae, quadrangular, with short, alternating septa, usually from 4–8 Valves panduriform Pseudoraphe scarcely evident Striae subtle, 30 (?) in 10 µ L of v. 12–17 µ.

Type locality Volcanic ash, Isle of France, Indian Ocean ?

Distribution. Fresh water Common in a pond near Eagle Cliff, Mt. Lafayette, N H Fossil in the Monmouth, Me, deposit. Lake Simon, Quebec

Illustrations Ehrenb, Mikrogeol, pl. 3, f 9 (?), pl 14, f. 52 (?); Van Heurck, Syn Diat Belg., pl 44, f 23, Lewis, Proc. Acad Phila 17 pl 2, f 3, Kitton, in Science Gossip 3. 180 f. 182 1867.

This little form, considered by Lewis as abnormal, is so abundant in several gatherings as to warrant its consideration as a separate species. As it is not described by either Ehrenberg or Van Heurck the synonymy is doubtful.

Species Insufficiently Described

Tabellaria thwaitesii Olney, Lens 1 135. 1872. "Allied to *Tabellaria flocculosa* but differing in inflation and end view.' Providence, R I" Not figured.

Species Excluded

Tabellaria amphilepta Ehrenb. Mikrogeol. pl 3, 4, f 32. Probably a variation of *T flocculosa ventricosa* (Kütz) Grun

Tabellaria nodosa Ehrenb. Mikrogeol. pl 4, 3, f 24. Not a *Tabellaria* but, apparently, a *Grammatophora* (Prit Inf , 807)

Tabellaria robusta Ehrenb Mikrogeol pl. 33, 11, f 15 Apparently *T flocculosa ventricosa* (Kütz) Grun

The above three forms are recorded as fossil in North America but have not been otherwise mentioned

44 **DIATOMELLA** Grev , Ann & Mag Nat Hist Ser 2, 15 259. 1855

Frustules quadrangular, divided longitudinally by two septa each with a central and terminal perforations Valves oblong or elliptical-lanceolate, slightly tumid in the middle, rounded at the ends Differs from *Grammatophora* in which the septa are curved and from *Tabellaria* in which the septa are not perforate at the ends.

Type species, *Diatomella balfouriana* Grev

1 **Diatomella balfouriana** Grev Ann & Mag Nat Hist Ser 2 15 259 1855
Grammatophora Balfouriana (Grev) W Smith, Syn Brit Diat 2 43 1856

Valves with striae 20–22 in 10 µ, finely punctate L of v 25–55 µ

Type locality England

Distribution Fresh water Rare and local Yellowstone Park

Illustrations Grev , Ann & Mag Nat Hist Ser 2, 15 pl 9, f 10–13, W Smith, Syn Brit Diat , 2 pl 61, f 383, Pritchard, Infusoria, pl 4, f 51, 52, Brun, Diat. Alpes. pl 9, f. 18, H L Smith, T. S 650

45 **TETRACYCLUS** Ralfs Ann. & Mag Nat Hist 12: 105 1843

Frustules single or in short fasciae, quadrate, septate, the septa usually curved and clavate, perforate, extending to about one-third the distance to the middle Valves costate, the costae coarse, transverse, sometimes oblique or interrupted in the middle Pseudoraphe scarcely evident

Type species, *Tetracyclus lacustris* Ralfs

1 **Tetracyclus lacustris** Ralfs, Ann. & Mag Nat Hist 12 105 1843
Biblarium stella Ehrenb Mikrogeol pl 33 1854

Valves elliptical, tumid in the middle, appearing cruciform. Costae coarse, 3–4 in 10 µ, usually interrupted or absent in the middle. Between the costae transverse, finely punctate lines, usually indistinct L of v 40 µ

Type locality: Wales

Distribution Fresh water. Morin Heights, Canada Lake Belanger P.Q. (Coll H. C. Wheeler)

Illustrations· Ann. & Mag Nat. Hist. 12: pl 4, f. 2, Pritchard, Infusoria, pl 8, f 10, W. Smith, Syn. Brit. Diat 2: pl. 39, f 308; Mikrogeol. pl. 33, f. 11, 12; Brun, Diat Alpes, pl. 8, f. 27.

Species Reported

Tetracyclus rupestris (A Braun) Grun., in Van Heurck, Syn. Diat. Belg. pl 52. 1881. *Gomphogramma rupestre* A. Braun in Rab Suess.-Wass. Diat. 33. 1853

Frustules usually single, quadrate, with septa extending to one-third the width Valves lanceolate-elliptical, with from two to eight or more transverse costae. Striae 18 in 10 μ. L of v. 5–20 μ

Type locality Frieburg, Germany.

Distribution· Fresh water. Localities given in North America doubtful.

Illustrations Van Heurck, Syn. Diat. Belg. pl. 52, f 13, 14, H. L. Smith, T. S. 174 Rab , Suess-Wass. Diat pl. 9.

This species, rare in Europe, has been reported from different localities in North America. In slides examined, however, the form has been proved to be *Diatoma hiemale mesodon* (Ehrenb.) Grun , which it resembles closely in valve view. *T rupestris* is distinguished by the great depth of the septa

46 GRAMMATOPHORA Ehrenb., Abh. Akad Berlin, 153 1839.

Frustules quadrangular, adnate or in zigzag chains, usually found free, divided by two nearly straight or sinuate, perforate septa. Valves linear or oblong, with straight, convex or sinuous sides, a pseudoraphe and transverse, punctate lines Chromatophores granular or, sometimes, in bands, with or without pyrenoids,

Type species, *Grammatophora angulosa* Ehrenb.

Divided by Grunow into two sections·

1. Frustules in zone view with straight or slightly curved septa.	
Septa with a semicircular curve near the ends. Valves linear-lanceolate, tumid in the middle.	1. *G. gibberula*
Septa bent near the ends.	2. *G. gibba*
Septa straight, the two central incrassate at the ends.	3. *G. arctica*
Septa straight, bent near the ends.	4. *G. peruana*
Septa straight, with a semicircular curve near the ends. Valves linear or linear-elliptical.	5. *G. marina*

Septa slightly undulate, curved near the ends. Valves linear-oblong, several times constricted	6	*G undulata*
Septa slightly curved near their origin, incrassate at the ends Valves linear	7.	*G maxima.*
Septa straight or nearly so Valves linear or linear-elliptical.	8	*G. parallela*
Septa straight with one undulation near the margin, incrassate at the ends Puncta very subtle	9	*G subtilissima*
Septa straight Valves linear, gibbous in the middle	10	*G caribaea*
2 Frustules with undulating septa		
Septa sigmoid	11	*G arnottii*
Septa hooked at the ends	12.	*G islandica*
Septa curved near their origin and bent into an angular, recurved hook	13	*G angulosa*
Septa with numerous undulations and hooked at the ends.	14	*G serpentina*
Septa with several undulations, hooked at the ends Valves arcuate	15	*G. arcuata*
Septa with four or more equal undulations, not hooked at the ends	16	*G flexuosa*

1 **Grammatophora gibberula** Kütz. Bac, 129 1844.

Frustules rectangular, with rounded angles Central septa with a semicircular curve near the ends Valves linear-lanceolate, obtuse at the ends and tumid in the middle. Striae transverse, 12 in 10 µ, punctate L. of v. 45 µ.

Type locality. Bay of Naples

Distribution Marine. West Indies

Illustrations Kütz, Bac., pl. 30, f. 81; Van Heurck, Syn. Diat. Belg., pl 53, f. 18

2 **Grammatophora gibba** Ehrenb., Abh Akad Berlin pl. 2 1843

Frustules with straight septa bent near the ends Valves transversely striated, tumid in the middle, obtuse at the ends (Kütz)

Type locality · Cuba.

Distribution. Marine. Known only from the type locality

Illustrations: Ehrenb., Abh. Akad Berlin, pl. 2, 6, f 8. 1843; Kütz., Bac., pl. 29, f. 77.

This species is insufficiently described and figured and it is impossible to determine in what respect it differs from *G. gibberula*

3. **Grammatophora arctica** Cleve, Oefvers. Vet.-Akad. Foerhandl. 10 664. 1867

Frustules quadrangular, rounded at the angles, with straight septa, the two central incrassate at the ends, the outer, shorter ones, simply straight, not thickened Valves linear-oblong, tumid in the middle, rounded at the ends Striae 12 in 10 μ L. of v. 65 μ.

Type locality Spitzbergen

Distribution Marine Greenland Behring Sea

Illustrations Cleve, Oefvers Vet-Akad Foerhandl 10. pl. 23, f 1, Van Heurck, Syn Diat Belg, pl. 53 bis, f 3, Grun, Denks. Akad Wien 48 pl 2, f. 15

4 **Grammatophora peruana** Ehrenb in Janisch, Abhandl Schles Ges Naturw med Abth 2 8 1862

Frustules quadrangular, with rounded ends Septa straight, bent near the ends Valves linear, with rounded ends Striae about 25 in 10 μ L of v 50 μ

Type locality Peru (in guano)

Distribution Marine Honduras Hudson Bay.

Illustrations Janisch, Abhandl Schles Ges Naturw-med Abth. 2: pl 2 (A), f 7, Janisch & Rab, in Rab Beitr Alg 1. pl 3, f 6

5 **Grammatophora marina** (Lyngb) Kütz, Bac., 128 1844.

Diatoma marinum Lyngb, Tent Hydrophyt Dan, 180 1819

Frustules quadrangular, with rounded angles Septa straight, with a semicircular curve near the ends Valves linear or linear-elliptical, with striae 20 in 10 μ L of v 60–80 μ

Type locality Faroes

Distribution Marine Atlantic and Pacific coasts

Illustrations Lyngb, Tent Hydrophyt. Dan, pl. 62, A; Kütz., Bac, pl 17, f 24 (1–6), pl. 18, f 6, W. Smith, Syn Brit Diat 2: pl 42, f 314, Pritchard, Infusoria, pl 4, f 47, pl 11, f. 52, 53; Van Heurck, Syn Diat Belg, pl 53, f 10, 11, Boyer, Diat. Phila, pl 8, f 17, 18

Grammatophora marina minor Grun, in Van Heurck, Syn Diat. Belg., pl 53, f 13. L of v 14–37 μ. Ormond, Fla.

Grammatophora marina ovaluensis Grun, in Van Heurck, Syn. Diat Belg, pl 53 bis, f. 24, 25. Frustules subquadrate, small. Valves gibbous in the middle Striae 13½–14 in 10 μ St Croix (Oestr).

6 **Grammatophora undulata** Kütz., Bac, 129. 1844.

Frustules quadrangular, with rounded angles. Septa slightly undulate Valves linear-oblong, several times constricted, with obtuse or subcapitate ends. Striae 20 in 10 μ. L. of v 50 μ.

This form ascribed to Ehrenberg by Kützing is not the form as figured in Mikrogeologie, pl 18, f. 87 b, as the valves are not undulate, but it appears to be as figured in pl. 19, f. 37 As both figures cannot refer to the same form the specific name is here assigned to Kützing.

Type locality Vera Cruz

Distribution Marine West Indies. Coast of Barbados Pacific Ocean.

Illustrations Kütz, Bac, pl 29, f 68 a (not c as stated), Van Heurck, Syn Diat Belg, pl 53 bis, f 17, Wolle, Diat. N America, pl 49, f 4, 5

Grammatophora undulata galapagensis Grun, in Van Heurck, Syn. Diat Belg., pl 53 bis, f. 20 Striae 27 in 10 µ St Croix (Oestr.).

Grammatophora undulata japonica Grun, in Van Heurck, Syn Diat Belg, pl 53 bis, f 18 Striae 31–32 in 10 µ St Croix (Oestr)

7 **Grammatophora maxima** Grun., Verh Zool-Bot Ges. Wien 12 416 1862

Frustules quadrangular, robust, with thick silex, elongated, with rounded angles. Septa slightly curved near their origin, straight to the incrassate ends. Valves linear, slightly constricted near the ends Striae subtle, 25 in 10 µ L of v to 210 µ

Type locality Kamtschatka

Distribution Marine Campeche Bay Port Townsend, Wash.

Illustrations Grun, Verh Zool-Bot Ges Wien 12 pl 5, f. 5, Van Heurck, Syn Diat Belg, pl 53 bis, f 12.

8. **Grammatophora parallela** Ehrenb Mikrogeol, pl 21 1854

Grammatophora tabellaria Ehrenb, Mikrogeol, pl 18, f 89, 90 (acc to Ehrenberg, but the figures do not correspond)
Grammatophora stricta Ehrenb, in Kütz, Bac, 129 1844

Frustules quadrangular, with rounded angles. Septa straight or nearly so Valves linear or linear-elliptical, rounded at the ends Striae subtle, 28 in 10 µ L. of v. 45 µ

Type locality Africa

Distribution Marine. West Indies.

Illustrations Ehrenb, Mikrogeol, pl 21, f 26; Kütz., Bac., pl. 29, f. 76 a.

9. **Grammatophora subtilissima** Bailey, in Pritchard, Infusoria 809 1861

Grammatophora marina subtilissima (Bailey) Van Heurck, Syn Diat. Belg, 164. 1885
Grammatophora oceanica subtilissima (Bailey) De-Toni, Syll. Alg., 2 755. 1892.

Frustules quadrangular, with rounded angles. Septa straight, with one undulation near the margin, incrassate at the ends. Valves linear, slightly constricted near the smooth ends. Puncta in quincunx, very subtle, 34–36 in 10 µ. L of v. 60–80 µ.

Type locality Atlantic Ocean.

Distribution · Marine. Atlantic Coast. Fossil at Providence, R. I.

Illustrations · Boyer, Diat Phila., pl. 8, f. 13, 14.

10 **Grammatophora caribaea** Cleve, Bih. Sv Vet.-Akad Handl 5^{8}: 14. 1873.

Frustules quadrangular, with straight septa. Valves linear, gibbous in the middle and at the ends Striae 28 in 10 µ. L. of v. 70–100 µ.

Type locality Virgin Islands

Distribution. Marine Coast of Barbados.

Illustrations. Cleve, Bih Sv Vet -Akad. Handl. 5^{8} pl 4, f 27.

Grammatophora caribaea floridana Mersechk , Polynesian Diatoms (Scripta Botanica, Universitatis Petropolitanae, Fasc 18.15. 1902.) Septa as in type but slightly convergent at the ends of the frustule. L. of v 69–136 µ. Coast of Florida.

11 **Grammatophora arnottii** Grun , in Van Heurck, Syn. Diat Belg., pl. 53 bis. 1881

Frustules subquadratic, small Valves elliptical Septa sigmoid Striae 19 in 10 µ.

Type locality New Zealand

Distribution Marine St Croix (Oestr.)

Illustrations Van Heurck, Syn Diat Belg , pl 53 bis, f 4.

12 **Grammatophora islandica** Ehrenb., Abh. Akad Berlin. 128 1843

Grammatophora serpentina Kütz. (not W. Smith), Bac , 129. 1844

Frustules quadrangular, with hyaline, rounded angles Septa robust, with several undulations, hooked at the ends Valves oblong-elliptical, with distinct pseudoraphe Striae distinctly punctate, 10 in 10 µ

Type locality Iceland.

Distribution Marine North Atlantic

Illustrations Kütz , Bac , pl 29, f 82, Boyer, Diat Phila , pl. 8, f. 19, 20; H L Smith, T S 186

13. **Grammatophora angulosa** Ehrenb , Abh. Akad Berlin, 154 1839

Grammatophora hamulifera Kütz., Bac., 128. 1844.

Frustules quadrangular, with septa curved near their origin and bent into a more or less angular, recurved hook. Striae subtle, 14–20 in 10 µ L. of v. 20–40 µ.

Type locality Oran, Algeria.

Distribution. Marine. - Atlantic and Pacific coasts.

Illustrations · Ehrenb., Mikrogeol., pl 18, f 88, pl 21, f. 88, pl. 19, f 35, Kütz , Bac , pl 17, f. 23, pl. 29, f. 79, pl. 30, f 79; Van Heurck, Syn. Diat. Belg., pl. 53, f. 4, Boyer, Diat. Phila., pl 8. f. 15, 16, H L. Smith, T. S. 185.

Grammatophora angulosa mediterranea Grun., Van Heurck, Syn. Diat. Belg., pl. 53, f. 5. Striae 17 in 10 μ. St. Croix (Oestr).

Grammatophora angulosa uncina (Leud) Van Heurck, Syn. Diat. Belg., pl. 53, f. 6 *Grammatophora uncina* Leud., Mém Soc. Émul. Côtes du Nord, 55 pl 5, f. 60. 1879. Striae 17 in 10 μ. St. Croix (Oestr).

14. **Grammatophora serpentina** W Smith (not Kütz.), Syn. Brit Diat 2 43 1856.
Grammatophora anguina Kütz, Bac, 129 (No. 9, named *G stricta*, in errore)

Frustules quadrangular, hyaline at the angles Septa with numerous undulations and hooked at the ends Valves linear-elliptical Striae punctate in quincunx, 17 in 10 μ. L of v. to 150 μ.

Type locality Europe.

Distribution · Marine Atlantic Coast

Illustrations Kütz, Bac., pl. 17, f 25, pl 29, f 82; W. Smith, Syn. Brit Diat 2: pl. 42, f 315, Boyer, Diat Phila., pl 8, f 21; H. L Smith, T S. 189

15 **Grammatophora arcuata** Ehrenb Mikrogeol pl 35 A. 1854
Grammatophora curvata Ehrenb, Mikrogeol, pl 35, A 1854

Frustules quadrangular, with rounded angles. Septa with several undulations, hooked at the ends Valves arcuate Striae distinctly punctate, 15 in 10 μ L. of v 30–50 μ

Type locality Arctic Sea

Distribution Marine. Coast of Greenland Hudson Bay

Illustrations Ehrenb, Mikrogeol., pl 35, A, 23, f 11, 12; Grun., Verh Zool -Bot. Ges Wien 12. pl 13, f 7

16. **Grammatophora flexuosa** Gryn. in Van Heurck, Syn. Diat. Belg., pl 53 bis. 1881
Grammatophora flexuosa hondurensis Grun, in Van Heurck, Syn Diat. Belg, pl 53 bis 1881
Grammatophora flexuosa delicatula Grun, in Van Heurck, Syn Diat Belg, pl 53 bis 1881.

Frustules quadrangular, with slightly rounded angles Septa with usually numerous undulations, not hooked at the ends. Valves linear, narrow Striae 17–24 in 10 μ. L of v. 30–84 μ.

Type locality. Honduras

Distribution. Marine Coast of Barbados Caribbean Sea

Illustrations Van Heurck, Syn. Diat Belg, pl. 53 bis, f. 22, 23.

In this and other species of *Grammatophora* the number of undulations of the septa depends often upon the length of the valve.

47. **STRIATELLA** Ag., Consp Crit. Diat., 60. 1832 Em. Heiberg, Consp. Diat., 71. 1863

Frustules tabulate, adnate in short, stipitate filaments, scarcely siliceous, divided into partitions, septate or partly so at alternate ends. Chromatophores granular, with pyrenoids.

Type species, *Fragilaria unipunctata* Lyngb.

Valves lanceolate, asymmetrical. Septa bent, extending the entire length.	1	*S. unipunctata*
Valves broadly oval Septate partitions alternately thickened at the ends	2	*S. lindigiana*
Valves ovate or oblong Septa close together	3	*S. intermedia*
Valves linear-elliptical. Septa robust, alternate, extending to the middle	4	*S interrupta*
Valves lanceolate, appearing hyaline Septa alternate, with arcuate folds at the middle.	5.	*S. hyalina*
Valves elliptical-lanceolate Septa alternating.	6	*S delicatula*
Valves broadly linear Septa numerous, imperfect	7	*S. chilensis*

1 **Striatella unipunctata** (Lynbg) Ag., Consp. Crit. Diat. 61 1832

Fragilaria unipunctata Lyngb., Tent Hydrophyt. Dan , 183. 1819

Frustules with numerous bent septa extending the entire length. Valves lanceolate, somewhat asymmetrical or sigmoid, subtly punctate Pseudoraphe quite distinct Oblique striae 18–20, transverse 30 in 10 µ. (Kitton) Chromatophores granular, collected in the centre of the frustule, with cuneate pyrenoids, forming a rosette

Type locality Norway

Distribution Marine Atlantic Coast.

Illustrations Lyngb , Tent Hydropht Dan., pl 62, f. G; Kütz , Bac , pl 18, f 5, pl 24, 6 f 3, W. Smith, Syn Brit. Diat 2. pl. 39, f. 307, Van Heurck, Syn Diat Belg., pl 54, f 9, 10, Boyer, Diat. Phila , pl 8, f. 22, 23

2. **Striatella lindigiana** Grun., Hedwigia 6 6 1867

Frustules subcylindrical, with septate partitions alternately thickened at the ends, longitudinally and transversely subtly punctate. Valves broadly oval or suborbicular, the pseudoraphe becoming forked or obsolete at the ends, punctate, the striae subradiating, 15–17 in 10 µ and 22–23 in 10 µ at the ends. L of v. 70–87 µ. (Grun., Mo Micr Jour. 18 171 1877)

Type locality Honduras.

Distribution · Marine. Known only from the type locality.

Illustrations Grun., Mo. Micr Jour. 18. pl 194, f. 5.

3. **Striatella intermedia** Grun., Hedwigia 6: 6. 1867

Frustules with the partitions closer than in *S. lindigiana*. Valves ovate or oblong, scarcely produced at the apices, obtuse. Pseudoraphe sometimes undulate. Terminal nodule conspicuous. Puncta subradial, 24–27 in 10 µ, the longitudinal 28–30 in 10 µ. L. of v. 69–126 µ. The pseudoraphe is sometimes divided into two branches which by reuniting and dividing form 2–4 oval spaces. (Grun Mo. Micr. Jour. 18: 171. 1877.)

Type locality. Honduras.

Distribution· Marine. Known only from the type locality.

Illustrations· Grun., Mo. Micr. Jour 18: pl. 194, f. 7.

4. **Striatella interrupta** (Ehrenb.) Heiberg, Consp. Diat., 73. 1863.
Tessella interrupta Ehrenb, Inf, 202. 1838

Frustules quadrangular, with rounded angles. Septa robust, alternate, extending to the middle Valves linear-elliptical, with distinct pseudoraphe. Puncta in zone view in quincunx, 22 in 10 µ.

Type locality Baltic Sea.

Distribution Marine. Atlantic Coast Rare.

Illustrations· Kütz., Bac., pl. 18, f 4, Pritchard, Infusoria, pl. 8, f. 5; Heiberg, Consp. Diat., pl. 5, f. 15, Van Heurck, Syn. Diat. Belg., pl 54, f 8; Boyer, Diat. Phila, pl 8, f 24.

5 **Striatella hyalina** (Janisch & Rab.) Rab, Fl Eur Alg. 1: 307 1864.
Tessella hyalina Janisch & Rab, in Rab, Beitr. Alg 1· 13. 1863.

Frustules quadrangular, hyaline, with alternate septa Valves lanceolate, minutely punctate, appearing hyaline, with two transverse, arcuate folds at the centre. L. of v 23 µ.

Type locality Honduras.

Distribution Marine Known only from the type locality.

Illustrations Janisch & Rab, in Rab., Beitr Alg 1. pl 2, f. 13.

6. **Striatella delicatula** (Kütz.) Grun., in Van Heurck, Syn. Diat. Belg., pl. 54. 1881
Hyalosira delicatula, *rectangula*, *obtusangula* and *minutissima* Kütz., Bac, 125. 1844.

Frustules quadrangular, with rounded angles, divided usually into from 8–10 partitions, the septa on each side alternating. Valves elliptical-lanceolate, subtly striate, the striae "36 in 10 µ." L. of v. 8–10 µ. L of frustule about 15 µ.

Type locality· North Sea.

Distribution Marine Greenland

Illustrations Kütz., Bac, pl. 18, f 3, Van Heurck, Syn Diat. Belg., pl. 54, f. 5, 6; Pritchard, Infusoria, pl. 14, f 23, 29; H. L. Smith, T. S. 202.

7 **Striatella chilensis** Grun., Novara-Exp. Bot. 1: 96. 1868.

Frustules quadrangular, with imperfect partitions more or less numerous, arcuate. Valves broadly linear, with hyaline, suborbicular area at the rounded apices. Striae transverse, delicate, parallel, 20 in 10 µ. Pseudoraphe more or less distinct L. of v. 10–20 µ. L. of frustule 15–32 µ. (Grun)

Type locality. Valparaiso

Distribution Marine. Greenland.

Illustrations· Grun., Novara-Exp. Bot. 1: pl. 1, A, f. 1.

(b) ENTOPYLINAE

1. *Entopyla*. Frustules arcuate Valves dissimilar. Costae alternating on each side of the pseudoraphe.

2 *Gephyria* Frustules arcuate Valves dissimilar Costae on each side of the pseudoraphe opposite each other

48. **ENTOPYLA** Ehrenb, Abh. Akad Berlin, 6. 1848

Frustules free or in very short chains, arcuate in zone view, divided by longitudinal septa, with a row of foramina on each border Valves linear or linear-elliptical, sometimes constricted, dissimilar, the lower or concave valve hyaline at the apices while the upper or convex valve is not Valves costate, the costae alternating on each side of the pseudoraphe Chromatophores numerous, circular discs

Type species, *Surirella australis* Ehrenb

1 **Entopyla australis** Ehrenb., Ahb Akad Berlin 6 1848.

Eupleuria incurvata Arnott, Quart Jour Micr Sci 6 90 1858
Achnanthes costata Johnston, Quart Jour Micr Sci 8 15 1860
Gephyria incurvata Arnott, Quart Jour Sci 8 20 1860
Entopyla incurvata (Arnott) Grun, Verh Zool-Bot Ges Wien 12 428. 1862.
Gephyria gigantea Grev, Trans Micr Soc Lond 14 122 1866
Gephyria constricta Grev, Trans Micr Soc Lond 14 77 1866

Valves linear, linear-elliptical or constricted, with rounded or cuneate ends Costae 1½–2 in 10 µ Between the costae are numerous, 6–10, transverse rows of fine puncta. The foramina correspond to the intercostal spaces and are close to the border, appearing as large cells in zone view In the concave or lower valve the apices are hyaline, in the upper or convex valve the costae radiate at the apices The lower valve is not only concave but is depressed along the longitudinal axis while the upper valve is convex throughout L of v 125–300 µ

Type locality Patagonian guano

Distribution Marine Pacific Coast.

Illustrations Johnston, Quart Jour Micr Sci. 8 pl. 1, f. 14; Grev., Trans Micr Soc Lond 14 pl. 8, f 2, pl. 11, f 7, 8, Pritchard Infusoria, pl 4, f 50, A. Schmidt, Atlas, pl 230, f. 1–16; H. L. Smith, T. S. 173

49. **GEPHYRIA** Arnott Quart. Jour Micr Sci 8 20 1860

Frustules free or in very short chains, arcuate in zone view, divided by longitudinal septa, with a row of foramina on each side of the pseudoraphe between it and the border Valves dissimilar, the lower or concave valve hyaline at the apices, the upper or convex valve not. Valves linear, costate, the costae on each side of the pseudoraphe opposite each other.

Type species, *Gephyria media* Arnott.

1 **Gephyria media** Arnott, Quart Jour Micr Sci 8 20. 1860.

Achnanthes angustata Johnston, Quart Jour Micr Sci 8 14. 1860

Prior to Arnott's description, it has been identified by Johnston with Greville's form and the name cannot be retained.

Valves linear, with transverse costae, about 7 in 10 µ, opposite each other on each side of the pseudoraphe. Between the costae are two rows of minute puncta. The foramina of the septa are between the centre and the border and are alternately nearer or further from the pseudoraphe, forming a zigzag row on each side. L. of v 125 µ

Type locality Elide guano

Distribution Marine Coast of California. Coast of Barbados.

Illustrations· Johnston, Quart Jour Micr Sci 8 pl. 1, f 13; Pritchard, Infusoria, pl 4, f. 49, Van Heurck, Treat Diat., f 98; A Schmidt, Atlas, pl 231, f. 18–21, pl 232, f 7–13; H L Smith, T S 662

9 Meridioneae

1 *Licmophora*. Frustules cuneate, in stipitate, fan-shaped fascicles Valves with a narrow or indistinct pseudoraphe Septa rudimentary

2. *Climacosphenia* Frustules cuneate, elongate, stipitate. Septa complete, perforate Valves clavate

3 *Meridion* Frustules cuneate, without septa Valves cuneate, costate.

4 *Sceptroneis* Frustules cuneate Valves clavate, not costate

50 **LICMOPHORA** Ag, Bot Zeit, 628 1827 Em Roper Trans. Micr Soc. Lond. 11 53 1863

Frustules flabellate, in clusters of two or more on short or long stipes, cuneate, septate, the septa more or less superficial Valves cuneate, usually elongated, convex, with transverse, punctate striae and a pseudoraphe Chromatophores scattered, rounded granules, or, sometimes, in several plates

Type species, *Echinella flabellata* Carm.

Mereschkowsky (Essay on a Natural Classification of Licmophora, Nuova Notarisia, Ser. 12 and 13, 25 1901), divides the species into seven groups described below.

Placatae Frustules delicate, with superficial septa Valves narrow, with fine striae. Chromatophores of two to four plates
Valves narrow, lanceolate-cuneate, enlarged at the base. 1 *L flabellata*
Dubiae. Frustules with thick walls and usually straight, shallow septa Valves bacil-

liform, attenuated from the rounded summit.	
Valves broad, abruptly attenuated at the base.	2. *L. ovulum*
Valves rounded at the apex, tapering to the subacute base.	3. *L. juergensii*
Debiles. Frustules delicate, with shallow septa. Valves clavate, abruptly attenuated; superior apex usually acute.	
Valves narrow, cuneate; apex hastate, acute; base long and narrow.	4. *L. hastata*
Valves narrow, cuneate, dilated at the apex, abruptly narrowed in a long, narrow base.	5. *L. remulus*
Paradoxae Frustules on elongated stipes of peculiar, not dichotomous ramification, with deep septa and rounded ends. Valves with rounded superior apex and distinct pseudoraphe.	
Valves narrow, obovate, rounded at apex and base.	6. *L. paradoxa*
Valves clavate or obovate, produced into a linear base.	7. *L. gracilis*
Valves clavate, abruptly constricted at the base.	8. *L. anglica*
Valves narrowly cuneate, with rounded apex and subacute base	9. *L. dalmatica*
Valves broad and rounded at apex, with sides parallel; attenuated at the base.	10. *L. lata*
Valves obovate-pyriform, rounded at the apex, suddenly narrowed at the base, hyaline.	11. *L. hyalina*
Valves clavate, appearing hyaline.	12 *L. tincta*
Profundeseptatae. Frustules with very deep septa. Valves as in Paradoxae. Striae distinct at the lower end.	
Valves broad in the middle, attenuated at the truncate apex and at the narrow base.	13. *L. monksiae*
Lyngbyeae. Frustules with deep septa. Valves attenuated at both ends, sometimes rostrate at the apex	
Valves clavate or oblanceolate, with subparallel margins toward the apex and narrowed at the base.	14. *L. lyngbyei*
Valves broad, cuneate at the apex, tapering to the subacute base	15. *L. pacifica*
Valves narrow, cuneate, abruptly attenuated at the apex, gradually attenuated to the base.	16. *L. rostrata*

Peristriatae Frustules usually sessile, robust, with thick cell walls.	
Valves broad, with broad pseudoraphe and robust striae.	
Valves oblanceolate, rounded or subcuneate at the apex, subacute at the base	17 *L. ehrenbergii*
Valves obovate, rounded or subconical at the apex, narrow at the base	18 *L. ovata*
Valves narrowly obovate, with obtuse base	19. *L. californica*
Species unclassified.	
Valves strongly clavate, slightly arcuate, inflated at the apex, attenuated at the truncate base.	20. *L thumii*
Valves obovate or suborbicular, produced at the base.	21 *L. baileyi*
Valves linear at the apex, attenuated in the middle, narrow and inflated at the base	22 *L montereyana*

PLACATAE Mereschk.

1 **Licmophora flabellata** (Carm) Ag , Consp Crit Diat., 41 1831

Echinella flabellata Carm 1826 Mss. in "Algae Appinensis" in Hooker's library at Kew, acc to Roper (Trans Micr Soc Lond 11 58 1863.)
Licmophora argentescens Ag , Consp Crit Diat , 41 1831
Licmophora splendida W Smith, Syn Brit Diat 1 85 1853 (not Grev.)

Frustules narrow, elongate, with superficial septa. Valves narrow, lanceolate-cuneate, enlarged at the base Striae subtle, 30 in 10 µ. L. of v. 111–415 µ (Mereschk)

Type locality · Scotland

Distribution Marine Atlantic Coast.

Illustrations. Kütz , Bac., pl. 12, f. 1–4, Bailey, Amer. Jour. Sci 43 pl. 5, f 8, Pritchard, Infusoria, pl 4, f. 9, pl. 10, f. 191–193, W. Smith, Syn. Brit. Diat., 1. pl 26, f 233, Van Heurck, Syn. Diat. Belg., pl 46, f. 2, 3, Boyer, Diat. Phila , pl. 9, f. 1, 2; H. L. Smith, T. S 208, 675

Licmophora flabellata parva Mereschk., Nuova Notarisia, Ser. 12, 8. 1901. Zone view broader and more cuneate than in type. L. of v. 61–139 µ San Pedro, Cal., Monterey, Cal.

DUBIAE Mereschk

2 **Licmophora ovulum Mereschk., Nuova Notarisia, Ser** *12 15. 1901*

Frustules cuneate, broad, upper angles rounded, robust; inferior apex broad, sometimes concave. Septa superficial, straight Valves broad, ovoid, more or less abruptly attenuated at the lower end. Superior apex broadly rounded; inferior narrow and somewhat produced. Pseudoraphe indefinite. Striae 24–25 in 10 µ. L. of v. 20–30 µ. (Mereschk., in part.)

Type locality · Black Sea

Distribution. Marine. Coast of New Jersey. Common.

Illustrations Mereschk., Nuova Notarisia, Ser. 12, pl., f. 18; Boyer, Diat Phila , pl 9, f 8, 9

3 **Licmophora Juergensii Ag , Consp Crit. Diat , 42 1831**
Podosphenia juergensii (Ag) Kütz , Bac , *121* 1844

Frustules cuneate, truncate at the upper end or slightly rounded. Septa superficial Valves rounded at the apex and tapering to the subacute base. Striae 18–19 in 10 µ. L. of v 42–70 µ.

Type locality North Sea

Distribution Marine Atlantic and Pacific Coasts

Illustrations Kütz., Bac , pl. 9, f 12, Van Heurck, Syn. Diat. Belg , pl 46, f 10, 11, H L. Smith, T S 428.

Licmophora juergensii capensis Grun., in Van Heurck, Syn. Diat Belg , pl 46, f 8 Striae 10½–14 in 10 µ Coast of California.

Licmophora juergensii dubia Grun , in Van Heurck, Syn Diat. Belg , pl. 46, f 12 Striae 19–20 in 10 µ Coast of California.

Licmophora juergensii latior (Mereschk) *Licmophora dubia latior* Mereschk , Nuova Notarisia, Ser 12, 5 pl., f 3. 1901. Valves rather broad Striae 24–25 in 10 µ. L of v 29 µ. Coast of California According to Mereschkowsky it passes into the type form.

Debiles Mereschk

4. **Licomophora hastata Mereschk., Nuova Notarisia, Ser 12 10 1901**

Frustules cuneate, narrow, with subacute angles Septa not deep Valves narrow, cuneate, the upper part somewhat hastate, with acute apex; the lower part long and narrow, with the base acute. Striae very fine L. of v. 31–67 µ (Mereschk).

Type locality Black Sea

Distribution. Marine. San Pedro, Cal Rare.

Illustrations Mereschk , Nuova Notarisia, Ser. 12, pl., f. 10.

5. **Licmophora remulus Grun., Hedwigia 6: 34. 1867.**
Podosphenia remulus Grun , Hedwigia 6 2. 1867.

Frustules cuneate, narrow, with upper angles subacute. Septa not very deep, curved. Valves cuneate, narrow, dilated at the upper part, with rounded apex and abruptly narrowed into a long, narrow blade Pseudoraphe distinct in the upper part. Striae 33–34 in 10 µ. L. of v 50–240 µ.

Type locality: Gulf of Trieste.

Distribution: Marine. Honduras.

Illustrations · Grun., Mo. Micr. Jour. 18, pl. 193, f. 1; Van Heurck, Syn. Diat. Belg , pl. 46, f. 4.

PARADOXAE Mereschk.

6. **Licmophora paradoxa** (Lyngb) Ag , Ic Alg. Eur pl. 32 1836.
Echinella paradoxa Lyhgb , Tent Hydrophyt Dan , 211 1819.
Gomphonema paradoxum Ag , Syst Alg , 11. 1824
Rhiphidophora paradoxa (Lyngb) Kütz , Bac , 122 1844
Podosphenia paradoxa (Lyngb) Rab Fl Eur 1 298 1864.

Frustules cuneate, broadly rounded or nearly truncate at the upper end, tapering to the narrow, truncate base Septa deep. Valves narrowly obovate, rounded at the apex and base, with very distinct pseudoraphe Striae 25 in 10 μ near the base to 30 in 10 μ near the apex L of v 60–90 μ

Type locality Denmark.

Distribution Marine Atlantic Coast.

Illustrations Lyngb , Tent Hydrophyt. Dan , pl 70, f. E; Kütz , Bac , pl 10, f 5; W Smith, Syn. Brit. Diat 1 pl 25, f 231; Van Heurck, Syn Diat Belg , pl 48, f 10–12, Boyer, Diat Phila , pl 9, f 6, 7, H L Smith, T S 699

7 **Licmophora gracilis** (Ehrenb) Grun , Hedwigia 6 34. 1867
Podosphenia gracilis Ehrenb , Inf pl 17 1838

Frustules cuneate, narrow, with not very deep septa Valves clavate or obovate, produced into a linear base Pseudoraphe distinct. Striae 20 in 10 μ L. of v. 37–90 μ

Type locality Baltic Sea

Distribution Marine. Atlantic Coast.

Illustrations Kütz , Bac , pl 9, f 10, 1, Van Heurck, Syn Diat. Belg , pl 46, f 13, Boyer, Diat Phila , pl 9, f 11, H. L Smith, T S 426

Licmophora gracilis elongata (Kütz) De-Toni, Syll Alg 2 732. 1892 *Rhiphidophora elongata* Kütz., Bac , 122 pl 10, f 6, Boyer, Diat. Phila , pl 9, f 12, 13. Valves with deeper septa and more extended base.

Podosphenia gracilis americana H L Smith, T. S 427, from Murray Bay, Can., appears to be a form of *L. gracilis*. L. of v. 45 μ

8 **Licmophora anglica** (Kütz.) Grun., in Van Heurck, Syn Diat. Belg., pl. 46. 1881
Rhiphidophora anglica Kütz , Bac., pl. 27, 5, f. 2, 4. 1844.

Frustules broadly cuneate, truncate at the base, rounded at the upper angles. Septa not deep. Valves clavate, abruptly contracted at the base. Striae 25 in 10 μ. L of v. 20–50 μ.

Type locality · England (parasitic on *Schizonema dillwynii*).

Distribution: Atlantic Ocean. Hudson Bay.

Illustrations. Van Heurck, Syn. Diat. Belg., pl. 46, f. 14.

9. **Licmophora dalmatica (Kütz.) Grun., Hedwigia 6: 35 1867**
Rhiphidophora dalmatica Kutz., Bac, 122 1844.
Podosphenia dalmatica (Kütz.) Rab Fl Eur 1·298 1864.

Frustles cuneate, with rounded angles and convex upper margin; subacute at the base Valves narrowly cuneate, with rounded apex and subacute base. Septa shallow, septal puncta distinct. Striae subtle, about 30 in 10 µ L of v 35 µ

Type locality Adriatic Sea

Distribution Marine Pacific Coast

Illustrations Kütz, Bac, pl 9, f 7, Van Heurck, Syn Diat. Belg, pl. 47, f 7; H L. Smith, T S 441.

10. **Licmophora lata Mereschk, Nuova Notarisia, Ser 12, 12 1901**

Frustules cuneate, with upper angles rounded and margin convex. Septa very deep. Valves broad, rounded at the apex, upper part with sides parallel; attenuated to the narrow base. Pseudoraphe very distinct Striae very fine L. of v. 48–73 µ

Type locality San Pedro Bay, Cal.

Distribution Marine Monterey Bay, Cal. Common.

Illustrations Mereschk., Nuova Notarisia, Ser 12, pl. f. 13.

11 **Licmophora hyalina (Kütz.) Grun, Hedwigia 6 36. 1867**
Podosphenia hyalina Kütz., Bac, 121. 1844

Frustules delicate, hyaline, scarcely siliceous, rounded at the upper margin, suddenly narrowed at the base. Septa deep. Valves obovate-piriform, rounded at the apex, narrow at the base. Pseudoraphe distinct Striae very subtle, 31 in 10 µ at the base, finer at the apex L of v. 45–55 µ

Type locality North Sea

Distribution. Marine Atlantic Coast.

Illustrations· Kütz, Bac., pl 9, f. 9; Pritchard, Infusoria, pl. 13, f. 13, Van Heurck, Syn. Diat. Belg, pl. 48, f. 6, 7; H. L. Smith, T S. 443

12 **Licmophora tincta (Ag) Grun., Hedwigia 6 35. 1867**
Gomphonema tinctum Ag, Consp, Crit Diat, 35. 1831
Rhiphidophora superba Kütz., Bac, 122. 1844
Podosphenia superba (Kütz.) Rab, Fl. Eur. Alg 1· 298. 1864.

Frustules cuneate, rounded at the upper end and tapering to the narrow, truncate base Septa rather deep, with septal puncta evident. Valves clavate, appearing hyaline, the striae about 27 at the lower end, increasing to about 33 in 10 µ at the upper end. L of v 40–110 µ. Stipes elongated, composed of two layers. Frustules usually in twos.

Type locality. Adriatic Sea.

Distribution: Marine. Atlantic Coast.

Illustrations Kütz., Bac., pl. 10, f. 7, Van Heurck, Syn. Diat Belg., pl. 48, f. 13–15; Boyer, Diat. Phila., pl. 9, f. 14–15, H. L. Smith, T. S. 444.

PROFUNDESEPTATAE Mereschk.

13 **Licmophora monksiae Mereschk., Nuova Notarisia, Ser 12, 14. 1901**

Frustules cup-shaped, with convex margins and rounded angles. Septa very deep, with distinct septal puncta. Valves broad in the middle, slightly attenuate at the truncate apex, sometimes broadly rounded, attenuated toward the narrow base. Striae 12–13 in 10 µ at the base, much finer toward the apex L of v. 24–33 µ. (Mereschk.)

Type locality San Pedro Bay, Cal.

Distribution: Marine. Known only from the type locality

Illustrations Mereschk , Nuova Notarisia, Ser. 12, pl. f. 16

LYNGBYEAE Mereschk

14 **Licmophora lyngbyei (Kütz.) Grun. Hedwigia 6 35 1867**

Echinella cuneata Lyngb , Tent. Hydrophyt Dan , 211 1819.
Podosphenia Lyngbyei Kütz , Bac , 121 1844.

Frustules cuneate, slightly rounded at the angles Septa deep. Valves clavate or oblanceolate, with margins subparallel toward the apex and narrowed and prolonged toward the base. Pseudoraphe distinct. Striae 12 in 10 µ near the base, 16 in 10 µ near the apex. L. of v. 50–70 µ.

Type locality Baltic Sea

Distribution Marine Atlantic coast.

Illustrations. Lyngb , Tent Hydropht Dan , pl. 70, f. F; Kütz., Bac., pl 9, f 10, 3; Van Heurck, Syn Diat Belg , pl 46, f 1, pl 47, f. 16–19; Boyer, Diat Phila , pl. 9, f. 3, 4.

15 **Licmophora pacifica Mereschk., Nuova Notarisia, Ser 12, 16. 1901**

Frustules broadly cuneate, with rounded upper angles and broad bases Septa rather deep; septal puncta very distinct. Valves broad, cuneate, round at the apex, tapering to the subacute base. Pseudoraphe distinct. Striae 11–12 in 10 µ L. of v. 26–43 µ. (Mereschk.)

Type locality· San Pedro Bay, Cal.

Distribution Marine. Known only from the type locality

Illustrations Not figured. Large specimens "resemble *L. juergensii capensis* Grun., but the septa are much deeper."

16. **Licmophora rostrata Mereschk., Nuova Notarisia, Ser 12, 21 1901.**

Frustules narrow, linear in the upper part, with angles subacute. Septa very deep; septal puncta very distinct. Valves narrow, cuneate, abruptly attenuated at the upper end into a long, narrow rostrum; gradually attenuated toward the lower end. Pseudoraphe distinct. Striae 13–14 in 10 μ in the middle. L of v 73–116 μ. (Mereschk.)

Type locality Black Sea

Distribution: Marine. San Pedro Bay.

Illustrations. Mereschk , Nuova Notarisia, Ser. 12, pl. f. 26.

PERISTRIATAE Mereschk

17 **Licmophora ehrenbergii** (Kütz) Grun., Hedwigia 6 36 1867

Podosphenia ehrenbergii Kütz , Bac., 121. 1844.

Frustules cuneate, with rather deep septa Valves oblanceolate, rounded or sometimes subcuneate at the apex, subacute at the base Pseudoraphe quite distinct Striae punctate, 8–9 at the base, 10–12 toward the apex in 10 μ. L of v. to 135 μ

Type locality Baltic Sea

Distribution Marine Atlantic Ocean

Illustrations Kütz , Bac , pl. 9, f. 13, Pritchard, Infusoria, pl. 13, f 14; W Smith, Syn. Brit Diat 1 pl 24, f 225; Van Heurck, Syn Diat. Belg , pl 47, f. 10, 11, Boyer, Diat Phila , pl. 9, f. 5, H. L. Smith, T S. 425.

18 **Licmophora ovata** (W Smith) Grun., Hedwigia 6 36 1857

Podosphenia ovata W Smith, Syn Brit. Diat 1 83. 1853

Frustules broadly cuneate, rounded at the upper margin, with rather deep septa Valves obovate, rounded or subconical at the apex and tapering to the subacute base Pseudoraphe quite distinct Striae transverse in the middle of the valve, radiate at the apex, 9–10 in 10 μ at the base, finer near the apex L. of v. 70–115 μ.

Type locality England.

Distribution Marine Coast of Barbados.

Illustrations W. Smith, Syn Brit Diat 1. pl. 24, f. 226; Van Heurck, Syn. Diat Belg., pl. 47, f 13 (forma barbadensis).

19 **Licmophora californica** Grun., in Van Heurck, Syn. Diat. Belg., pl. 47 1881

Frustules broadly cuneate, with convex upper margin and very deep septa. Valves narrowly obovate, with rounded, sometimes slightly acuminate apices and obtuse, sometimes narrow and prolonged, bases. Pseudoraphe broad. Striae oblique, 8 in 10 μ. L. of v to 115 μ. The striae are usually transverse in the middle and convergent at the apex and base.

Type locality. Coast of California.

Distribution. Marine. Pacific Coast.

Illustrations. Van Heurck, Syn. Diat. Belg., pl. 47, f. 14.

Species Unclassified

20. Licmophora thumii Mereschk., Nuova Notarisia Ser 12 23 1901

Frustules cuneate, with upper angles subacute Septa deep Valves strongly clavate, usually slightly arcuate and asymmetrical, inflated at the upper part and attenuated toward the broad and truncate apex, abruptly attenuated toward the base, with the inferior end inflated. Pseudoraphe very distinct, terminating in a pseudonodule at the apex Striae 16–17 in 10 μ L of v 93–179 μ

Type locality Monterey Bay, Cal.

Distribution Marine. Known only from the type locality.

Illustrations Mereschk, Nuova Notarisia, Ser 12, pl, f 30.

21 Licmophora baileyi (A. M Edwards) Grun, Hedwigia 6 36 1867

Podosphenia Baileyi A M Edwards, in Lewis, Proc Acad Phila 13 67. 1861.

Frustules delicate, broadly cuneate, with deep septa, turgid, rounded above and produced at the base Valves obovate or suborbicular, rounded at the apex, usually produced at the base. Pseudoraphe distinct Striae 20 in 10 μ L of v 40 μ

Type locality Long Island Sound, N Y.

Distribution Marine Atlantic coast

Illustrations Lewis, Proc Acad Phila 13 pl 2, f 8, Boyer, Diat Phila., pl 38, f. 3, 4; H. L Smith, T S 423

22 Licmophora montereyana Mereschk, Nuova Notarisia Ser 12, 15 1901

Frustules with deep septa Valves linear in the upper part, with the apex broadly rounded, abruptly attenuated in the middle to a linear and very narrow base inflated at the end Pseudoraphe invisible. Striae 23 or more in 10 μ. L. of v 113 μ. (Mereschk.)

Type locality Monterey Bay

Distribution· Marine Known only from the type locality.

Illustrations Mereschk., Nuova Notarisia, Ser 12, pl, f 17

51 CLIMACOSPHENIA Ehrenb., Abh. Akad. Berlin, 401 1841

Frustules cuneate, usually in clusters of two or more, on short or long stipes. Septa two, with numerous, rounded foramina Valves clavate, elongated, with fine striae Chromatophores granular, numerous.

Type species, *Climacosphaenia moniligera* Ehrenb.

Frustules on short stipes	1. *C moniligera*
Frustules on long stipes	2. *C. elongata*

1 Climacosphenia moniligera Ehrenb., Abh. Akad Berlin, 411 1843

Frustules on very short stipes, cuneate, narrow, with upper margin slightly rounded at the angles, base truncate. Septa two, with numerous foramina which are usually rounded or subquadrate. Valves clavate, rounded at the apex and elongated below, traversed longitudinally by two parallel blank lines Pseudoraphe scarcely evident Striae subtle, 22 or more in 10 µ on the valve, 16 in 10 µ on the zone L. of v. 170 µ or more

Type locality. Gulf of Mexico

Distribution Marine. Cuba Barbados. Honduras. California

Illustrations Ehrenb., Abh Akad Berlin, 1843. pl 2, 6, f. 1; Kütz, Bac, pl 29, f. 80; Janisch & Rab., in Rab Beitr. Alg. 1: pl 2, f 1, Grun, Verh, Zool-Bot. Ges Wien 13: pl 5, f. 17, A. Schmidt, Atlas, pl 307, f 1–9, H L Smith, T S 631

2. **Climacosphenia elongata** Bailey, Smith, Contr 7: 8. 1853.

Frustules in fan-shaped clusters on long, branching stipes, cuneate, narrow, with slightly rounded angles and truncate bases. Valves clavate, rounded at the apex and elongated below, traversed by two parallel longitudinal blank lines Pseudoraphe indistinct. Striae 22 in 10 µ on the valve and about 16 in 10 µ on the zone. L of v. to 340 µ.

Type locality Florida

Distribution Marine. Atlantic Coast, southward

Illustrations Bailey, Smith. Contr. 7. 8, f. 3, pl f. 10, 11, Grun., Verh Zool-Bot Ges. Wien 12 pl 3 (6), f. 22; A. Schmidt, Atlas, pl. 308, f 5–10

52 MERIDION Ag., Syst Alg., xiv (pref) 1824.

Frustules cuneate, in circular or spiral fasciae, at length becoming free. Valves more or less cuneate, with transverse costae and striae Chromatophores numerous, small, elongated, in regular rows on the zone.

Type species, *Echinella circularis* Grev.

Valves obovate or clavate. Costae coarse.	1. *M. circulare*
Valves clavate, constricted at the apex.	2. *M. constrictum*
Valves cuneate Costae indistinct.	3. *M. intermedium*

1. **Meridion circulare** (Grev) Ag., Consp. Crit. Diat., 40. 1831

Echinella circularis Grev., Scot Crypt Fl 1 pl 35 1823.

Valves clavate or obovate. Costae coarse, usually from 9–11, at variable distances apart, sometimes interrupted or indistinct. Striae interstitial, 16 in 10 µ. L. of v. 18–72 µ. Sporangial forms irregular in shape, more or less tumid in the middle, with indistinct costae

Type locality. Scotland.

Distribution: Fresh water. Common.

Illustrations Kütz., Bac. pl. 7, f. 16, 1; Rab. Suess. Diat. pl. 1, f. 1; W. Smith, Syn Brit. Diat. 2· pl. 32, f 277, Boyer, Diat. Phila., pl. 10, f. 1–3.

2 **Meridion constrictum Ralfs, Ann. & Mag. Nat. Hist. 12: 458. 1843**

Valves clavate, constricted near the apex Costae 8–10, with interstitial, delicate striae L.˙ of v 15–45 µ. Internal septa are not infrequent in *M circulare* and *M constrictum.*

Type locality· England.

Distribution Fresh water Common Usually found with *M. circulare* of which it is sometimes considered a variety.

Illustrations Ralfs, Ann & Mag Nat. Hist 12. pl 18, f. 2; W. Smith, Syn. Brit Diat. 2. pl. 32, f 278; Van Heurck, Syn. Diat Belg, pl. 51, f. 13–17; H. L Smith, T. S. 236.

3. **Meridion intermedium H L Smith, Amer Quart. Micr Jour 1: 12 1878**

Frustules cuneate, sessile. Valves cuneate, with indistinct costae, rounded at the apex, sometimes constricted. L. of v 40–75 µ.

Type locality Tennessee

Distribution. Fresh water Known only from the type locality.

Illustrations· Amer. Quart Micr. Jour 1 pl. 3, f 2; H L Smith, T S. 238.

53 **SCEPTRONEIS Ehrenb, Ber Akad Berlin, 264. 1844.**

Frustules cuneate Valves clavate, lanceolate Striae transverse, moniliform. Pseudoraphe narrow.

Type species, *Sceptroneis caduceus* Ehrenb.

1 **Sceptroneis caduceus Ehrenb., Ber Akad Berlin, 271 1844.**

Valves clavate, tumid in the middle, capitate at each end. Striae coarse, moniliform, 3 in 10 µ Pseudoraphe indistinct L. of v. 150 µ or more.

Type locality. Miocene fossil deposits

Distribution. Marine. Port Antonio, Jamaica. Colon. Rare.

Illustrations: Ehrenb., Mikrogeol., pl. 33, 17, f. 15; Greg., Trans. Roy. Soc. Edinb. 21· pl. 14, f. 106; Pritchard, Infusoria, pl. 4, f. 11; Van Heurck, Syn. Diat Belg., pl 37, f. 5.

Sceptroneis is of very rare occurrence in a living state in North America although common in the Miocene and later deposits.

Species Excluded

The following forms, as Kitton remarks (Mo. Micr. Jour. 18: 170. 1877), are not "rightly placed in the genus Sceptroneis":

Sceptroneis gomphonema (Janisch & Rab.) Grun., Mo. Micr. Jour. 18: 169, is *Synedra gomphonema* Janisch & Rab.

Sceptroneis dubia Grun , Mo. Micr Jour. 18. 169, is not a *Sceptroneis* and appears to be a *Synedra.*

Sceptroneis cuneata Grun , Mo. Micr. Jour. 18· 169, is *Synedra cuneata* Grun.

10. Fragilarieae

Divided into three sections·

(a) Diatominae Valves circular, elliptical to linear, quadrate or cruciform, with transverse costae. Pseudoraphe sometimes absent.

(b) Fragilariinae. Valves elongate, without costae, but with transverse, punctate striae, without genuine central nodule.

(c) Eunotiinae Valves lunate A raphe sometimes partly formed with terminal nodules near the edges

(a) DIATOMINAE

1. *Diatoma.* Frustules in filaments Valves linear or elliptical, costate

2. *Plagiogramma* Frustules in fasciae or free Valves costate.

3 *Opephora* Frustules free Valves usually cuneiform, costate.

54 **DIATOMA DC Fl Fr 2 48 1805 Em Heiberg, Consp. Diat , 55 1863.**

Frustules oblong or quadrate, adnate in filaments at first, attached by alternate angles and finally separating Valves linear or elliptical, with transverse costae and punctate striae Pseudoraphe evident Chromatophores large granules without definite arrangement

Type species, *Diatoma vulgare* Bory

Valves lanceolate or linear, with rounded apices	1 *D vulgare*
Valves lanceolate or linear, with produced, capitate apices.	2 *D elongatum*
Valves oblong-lanceolate, rounded at the apices	3 *D hiemale*
Valves narrow, linear, with rostrate or capitate apices	4 *D. anceps*

1 **Diatoma vulgare Bory, Dict. Hist. Nat , pl 20 1828**

Bacillaria vulgaris (Bory) Ehrenb , Inf , 197 1838

Frustules quadrangular, with straight sides or slightly constricted in the middle. Valves lanceolate or linear, with rounded apices Costae about 6 in 10 μ, often at unequal intervals, and subtle, punctate striae, 14 in 10 μ L of v. 40–50 μ. At one end of each valve, at alternate ends of each frustule, a plasma pore is more or less evident, by which the frustules adhere and, in separating, produce zigzag chains. The pore is probably found in all species of *Diatoma.*

Type locality. Europe.

Distribution. Fresh water. Common

Illustrations · Kütz, Bac., pl 17, f. 15, 1–4; W. Smith, Syn. Brit. Diat 2. pl. 40, f 309; Ralfs in Pritchard, Infusoria, pl. 4, f. 13, Brun, Diat. Alpes, pl 4, f. 13; Van Heurck, Syn Diat Belg., pl 50, f. 1–6; Boyer, Diat Phila., pl 10, f. 9, 10.

Diatoma vulgare productum Grun, Verh Zool.-Bot Ges. Wien 12 363 1862 With produced, obtuse apices. W. Smith, Syn. Brit Diat 2· pl 40, f 309 a′

Diatoma vulgare breve Grun, Verh Zool.-Bot Ges Wien 12· 363. 1862 Valves ovate-lanceolate, short, obtuse W. Smith, Syn Brit Diat. 2: pl 40, f 309 a″

Diatoma vulgare genuinum Grun, Verh. Zool.-Bot Ges Wien 12· 363 1862. Valves lanceolate, with produced apices W Smith, Syn Brit Diat 2· pl 40, f 309 B

Diatoma vulgare capitulatum Grun, Verh Zool -Bot Ges Wien 12 364. 1862. Valves lanceolate, short, with apices capitate-constricted

Diatoma vulgare ehrenbergii (Kütz) Grun, Verh Zool -Bot Ges. Wien 12 364 *Diatoma Ehrenbergii* Kütz, Bac, pl 17, f 17. Valves elongate, linear-lanceolate, with apices capitate-constricted.

Diatoma vulgare grande (W. Smith) Grun, Verh. Zool -Bot. Ges. Wien 12 364. 1862 Valves linear, much elongated, capitate-constricted at the apices *Diatoma grande* W Smith, Syn Brit Diat 2 39. pl 40, f 310.

Diatoma vulgare constrictum Grun, in Van Heurck, Syn. Diat Belg, pl. 50, f. 9

Diatoma vulgare lineare Grun, in Van Heurck, Syn Diat Belg, pl 50, f 7, 8 Valves linear

The above varieties have intermediate forms occurring with the type.

Denticula obtusa Kütz, Bac, 44, pl. 17, f 14, 1844, is supposed to refer to this species but the identification is quite uncertain

2 Diatoma elongatum (Lyngb) Ag, Syst Alg, 4 1824.

Diatoma tenue elongatum Lyngb, Tent Hydrophyt Dan, pl 61, E f 1, 2 1819

Valves lanceolate or linear, sometimes ten times the diameter to 100 μ, with produced, capitate apices. Costae delicate, 4–7 in 10 μ. Striae subtle, 14–17 in 10 μ. Zone view very narrow, constricted in the middle Very near *D vulgare ehrenbergii* and *D. vulgare grande.*

Type locality. Denmark

Distribution. Fresh water. Not common.

Illustrations: Kütz., Bac., pl. 17, f. 18, 1, 2; W. Smith, Syn. Brit. Diat. 2: pl. 40, f. 311; Brun, Diat. Alpes, pl. 4, f. 16; Van Heurck, Syn. Diat. Belg., pl. 50, f. 14 c, 18–22; H. L. Smith, T. S. 134.

Diatoma elongatum tenue (Ag.) Van Heurck, Syn. Diat. Belg., pl. 50, f. 14, a, b. *Diatoma tenue* Ag., Syst. Alg., 4, 1824. Valves narrow, slender, with apices slightly capitate. West Indies. Gambier, Ohio. Van Heurck states that the variety and type occur in both fresh and brackish water. H. L. Smith, T. S. 136.

For variation in *Diatoma* see Cholnoky, Ungarische Botanische Blätter, 1925.

3. Diatoma hiemale (Lyngb.) Heiberg, Consp Diat., 58 1863.

Fragilaria hiemalis Lyngb , Tent Hydrophyt Dan , 185. 1819.
Odontidium hiemale Kütz., Bac , 44. 1844.

Frustules rectangular, the ends of the costae nodular. Valves oblong-lanceolate, rounded at the apices. Costae 6–12 Striae subtle. L. of v. 30–50 µ.

Type locality Faroës.

Distribution Fresh water, in cold streams and springs.

Illustrations Lyngb , Tent. Hydrophyt. Dan , pl. 63, E; Kütz., Bac., pl. 17, f. 4, W. Smith, Syn. Brit Diat. 2. pl 34, f. 289; Ralfs in Pritchard, Infusoria, pl. 13, f. 24, 25, H L. Smith, T. S 381.

Diatoma hiemale turgidulum (Ehrenb) Grun., Verh. Zool.-Bot. Ges. Wien 12. 356. 1862. *Fragilaria turgidula* Ehrenb., Inf., 204. pl. 15, f 13. 1838. *Odontidium glaciale* Kütz , Bac., 44. pl. 17, f. 3. Valves shorter than in the type. Costae 4–6. Occasional with the type.

Diatoma hiemale mesodon (Ehrenb) Grun., Verh. Zool.-Bot. Ges. Wien 12. 357. 1862. *Odontidium mesodon* (Ehrenb.) Kütz., Bac., 44. pl 17, f. 1. Valves ovate-lanceolate, 12–25 µ in length. Costae 2–4. Boyer, Diat. Phila., pl. 10, f. 7, 8. H. L. Smith, T. S. 382. Katmai Pass, Alaska Common in springs near Philadelphia.

4. Diatoma anceps (Ehrenb.) Kirchn. Krypt.-Fl. Schles. 2^1: 204. 1878.

Odontidium anceps Ehrenb , Abh. Akad Berlin, 127. 1843.
Odontidium anomalum W. Smith, Syn. Brit. Diat. 2: 16. 1856.
Fragilaria capitata Ehrenb., Mikrogeol., pl. 35, A, 12, f 2. 1854.

Frustules quadrangular, elongate. Valves narrow, linear, with rostrate or capitate apices. Costae 5–16, sometimes oblique. Striae 21 in 10 µ. L. of v. 20–50 µ. W. Smith notes the presence of internal valves as in *Eunotia pectinalis soleirolii* in his species, *Odontidium anomalum* The internal valves occur in this form at Fall Mt , Conn

Type locality Europe

Distribution Fresh water Generally distributed

Illustrations Ehrenb , Mikrogeol , pl 3, 1, f 22, W Smith, Syn Brit Diat 2 pl 61, f 376, Brun, Diat Alpes, pl 4, f 6, Van Heurck Syn Diat Belg , pl 51, f 5-8, Boyer, Diat Phila , pl 10, f 5, 6, H L Smith, T S 377

Diatoma anceps capitatum Perag , in Terry, Rhodora 10 181. 1908 This form from Fall Mt , Conn is exactly that of H L. Smith, T S 378, from the St Lawrence River, and labelled *Odontidium anomalum* W Smith

55 PLAGIOGRAMMA Grev , Quart Jour Micr Sci. 7 208 1859

Frustules quadrangular, in short fasciae, or, usually, free Valves with costae, central or central and terminal, sometimes absent Striae transverse Central space and ends usually hyaline

Type species, *Denticella staurophora* Greg

Costae two, central	
Valves lanceolate Median space extending to margin	1 *P staurophorum*
Valves elliptical-lanceolate Median space half the diameter of valve	2 *P tessellatum*
Valves elliptical-lanceolate, constricted in middle	3 *P spinosum*
Costae four, two central and two terminal	
Valves linear-elliptical, obtuse Striae 4 in 10 µ	4 *P pulchellum*
Valves linear, slightly inflated in the middle	5 *P validum*
Valves linear, slightly inflated in the middle Terminal costae deeper than the others	6 *P inaequale*
Valves linear-elliptical Striae 7 in 10 µ	7. *P pygmaeum*
Valves linear, with rounded ends	8 *P wallichianum*
Valves rhombic-lanceolate, tumid in the middle.	9 *P obesum*
Valves linear-lanceolate, constricted in the middle.	10 *P lyratum*
Valves lanceolate or linear-lanceolate, constricted in the middle. Costae connected by a rib on each margin	11 *P. caribaeum*
Valves linear-lanceolate, tapering to the ends.	12. *P. attenuatum*
Valves oblong-elliptical, Terminal costae obsolete	13. *P. decussatum*

Valves linear-lanceolate Pseudoraphe absent. 14 *P antillarum*

Costae absent or indistinct

Valves constricted in the middle Segments dilated 15 *P papilio*

Valves lanceolate, constricted in the middle 16. *P. labuense*

1 **Plagiogramma staurophorum** (Greg) Heiberg, Consp Diat, 55 1863

Denticella staurophora Greg, Trans Roy Soc Edinb 21 496 1857
Plagiogramma gregorianum Grev, Quart Jour Micr Sci 7 208 1859

Frustules quadrangular, free, or two or three together Valves lanceolate or oblong-lanceolate, the hyaline median space extending to the margin, bounded by two costate lines which are slightly concave toward the ends of the valve Pseudoraphe narrow or indistinct Striae in transverse or slightly radiate lines of puncta, 7–9 in 10 μ, in longitudinal rows Ends of valve hyaline, without costae L of v 45 μ Variable in outline.

Type locality Scotland

Distribution Marine Greenland. Florida Honduras.

Illustrations Greg, Trans. Roy Soc Edinb 21 pl 10, f 37, Grev, Quart Jour Micr Sci 7 pl 10, f 1, 2, Van Heurck, Syn Diat Belg, pl 36, f 2, A Schmidt, Atlas, pl 209, f 12, 13, 14, 27, 35

2 **Plagiogramma tessellatum** Grev, Quart Jour Micr Sci 7 208 1859.

Frustules quadrangular Valves elliptical-lanceolate Central hyaline space elliptical, transverse to the major axis, usually about half the diameter of the valve Pseudoraphe not distinct Terminal hyaline, spaces ovate Striae transverse, with large, quadrate, granular markings, 3 in 10 μ Central costae absent L of v. to 100 μ

Type locality California guano

Distribution Marine Atlantic Coast, southward

Illustrations Grev, Quart Jour Micr Sci 7 pl 10, f 7, A Schmidt, Atlas, pl. 209, f 42–44, Boyer, Diat. Phila., pl. 10, f. 11

3 **Plagiogramma spinosum** Cleve Sv Vet.-Akad Handl II 18^{5}: 18 1881

Valves in general outline lanceolate-elliptical, constricted in the middle and again constricted and produced at the rounded ends Pseudoraphe scarcely evident Central space hyaline, oblong, reaching the margin, bounded by broad costae. Striae transverse, the rows of puncta 10–11 in 10 μ Terminal spaces hyaline, elliptical A row of strong spines evident on the margin about 5 in 10 μ. L of v. 50–80 μ.

Type locality: Galapagos Islands.

Distribution Marine Campeche Bay. Rare.

Illustrations Cleve, Sv Vet.-Akad Handl. II 18^5 pl 4, f 55; A. Schmidt, Atlas, pl 211, f 27, 28

4. **Plagiogramma pulchellum** Grev, Quart Jour Micr Sci 7 209 1859

Valves linear-elliptical, obtuse Pseudoraphe distinct Costae two central and two terminal Striae punctate, 4 in 10 µ L of v 55-120 µ

Type locality Nassau, Bahamas

Distribution Marine West Indies

Illustrations Grev, Quart Jour Micr Sci 7 pl 10, f 4-6, Ralfs, in Pritchard, Infusoria, pl 4, f 32

5 **Plagiogramma validum** Grev, Quart. Jour Micr Sci 7 209. 1859

Valves linear, slightly inflated in the middle. Costae two central and two terminal Pseudoraphe distinct Striae 7 in 10 µ, punctate L of v 84-120 µ

Type locality California guano

Distribution Marine Pacific Coast

Illustrations Grev, Quart Jour Micr Sci 7 pl. 10, f 8

Plagiogramma validum tumidulum Grun, A Schmidt, Atlas, pl 210, f 2, 3 1897 More inflated in the middle than the type form L of v 115 µ Campeche Bay Common

6 **Plagiogramma inaequale** Grev Quart Jour Micr Sci 7 210 1859

Frustules broad, with the terminal deeper than the two middle costae Valves linear, slightly tumid in the middle Pseudoraphe evident Striae about 7 in 10 µ, punctate L of v 35 µ Resembles a small *P validum*

Type locality Jamaica

Distribution Marine. West Indies Honduras Campeche Bay

Illustrations Grev, Quart Jour Micr Sci 7 pl 10, f 10, Janisch & Rab in Rab Beitr Alg 1 pl 2, f 20 1863

7 **Plagiogramma pygmaeum** Grev Quart. Jour Micr Sci 7 211 1859.

Valves linear-elliptical Pseudoraphe distinct Striae 7 in 10 µ L. of v 30 µ

Type locality Nassau, Bahamas

Distribution Marine Atlantic Coast Rare

Illustrations Grev, Quart Jour Micr Sci 7 pl 10, f 11, Boyer, Diat Phila., pl. 10, f 13

8 **Plagiogramma wallichianum** Grev, Trans. Micr Soc. Lond 13 1 1865.

Valves linear, with rounded ends Pseudoraphe absent. Striae about 8 in 10 µ, evident also in the central and terminal spaces L of v 33-42 µ Near *P pygmaeum*, from which it differs in outline and striae (De-Toni).

Type locality St Helena

Distribution Marine Delaware River mud. Rare

Illustrations. Grev, Trans Micr Soc. Lond 13 pl 1, f 7, 8, Boyer, Diat Phila, pl 10, f 14, A Schmidt, Atlas, pl 209, f 20, 21

9 **Plagiogramma obesum** Grev Quart Jour Micr Sci 7 211 1859

Valves rhombic-lanceolate, tumid in the middle Pseudoraphe distinct Striae about 6 in 10 µ, sometimes slightly radiate L of v 35-60 µ

Type locality Nassau Bahamas

Distribution Marine Atlantic Coast, southward West Indies.

Illustrations Grev, Quart Jour Micr Sci 7 pl. 10, f 12, 13, A Schmidt, Atlas, pl 209, f 31, pl 210, f 7, 8, Boyer, Diat Phila, pl 10, f 12

10 **Plagiogramma lyratum** Grev, Quart. Jour Micr Sci 7 211 1859

Valves linear-lanceolate, constricted in the middle Pseudoraphe distinct Striae about 9 in 10 µ L of v 63–100 µ

Type locality Nassau, Bahamas

Distribution Marine Campeche Bay.

Illustrations Grev, Quart Jour Micr Sci 7 pl 10, f 14

11 **Plagiogramma caribaeum** Cleve Bih Sv Vet-Akad Handl 5^8 10 1873

Valves lanceolate or linear-lanceolate, constricted in the middle Pseudoraphe distinct On each side near the margin a strong rib connects the central and terminal costae Striae about 9 in 10 µ, crossing both the central and terminal spaces L of v to 88 µ

Type locality Virgin Islands

Distribution Marine Campeche Bay

Illustrations Cleve, Bih Sv Vet-Akad Handl 5^8 pl 3, f 17, A Schmidt, Atlas, pl 211, f 26

Plagiogramma caribaeum forma *pusilla* A Schmidt, Atlas, pl 211, f 19 Valves with segments more tumid than in type and with the ends somewhat acute L of v 40 µ Campeche Bay

12 **Plagiogramma attenuatum** Cleve, Bih Sv Vet-Akad Handl. 5^8: 10 1873

Valves linear-lanceolate, tapering to the small apices Pseudoraphe absent Striae 10 in 10 µ L of v 50 µ The central costae form a quadrangular annulus. (Description from Cleve who found one specimen only.)

Type locality St Bartholomew

Distribution Marine. Known from the type locality only.

Illustrations. Cleve, Bih. Sv. Vet.-Akad. Handl. 5^8: pl. 3, f. 18.

13 **Plagiogramma decussatum** Grev, Trans. Micr Soc Lond 14 1 1866.

Valves oblong-elliptical Pseudoraphe not evident Terminal costae absent Striae about 8 in 10 µ, somewhat radiate L of v 21–55 µ

Type locality St Helena

Distribution Marine West Indies Campeche Bay Mosquito Inlet, Fla

Illustrations Grev, Trans Micr Soc Lond 14 pl 1, f 1, 2; A Schmidt, Atlas, pl 209, f 25

14. **Plagiogramma antillarum** Cleve Bih Sv Vet-Akad Handl 5^8 10 1873

Valves linear-lanceolate, slightly tumid in the middle Pseudoraphe absent or indistinct Striae 8 in 10 µ L of v 42–80 µ

Type locality Virgin Islands

Distribution Marine Shark River, N J Rare

Illustrations Cleve, Bih Sv Vet-Akad Handl 5^8 pl 3, f 16, Leud, Mém Soc Émul Côtes-du-Nord, pl 9, f 92 1879

15 **Plagiogramma papilio** Cleve and Grove Le Diatomiste 1 55 1891

Valves constricted in the middle, with produced apices, the segments dilated Pseudoraphe and costae absent Central space a circular pseudonodule surrounded by a hyaline area Striae 9–10 in 10 µ Terminal spaces elliptical L of v 45–48 µ Resembles *P nankoorense* Grun, which, however, has striae 7 in 10 µ, with granules more scattered

Type locality Straits of Macassar

Distribution Marine Campeche Bay

Illustrations Cleve and Grove, Le Diatomiste 1 pl 8, f 17, A Schmidt, Atlas, pl 211, f 13

16 **Plagiogramma tabuense** Cleve, Vega Exp Iaktt 3 498 1883

Valves lanceolate, slightly produced at the ends, constricted in the middle. Central nodule large, circular, reaching the margin Costae not evident, the inturned edges of the valve appearing as a diaphragm Striae 11–14 in 10 µ punctate, the puncta in longitudinal rows Pseudoraphe narrow, distinct L. of v 40–50 µ

Type locality Borneo

Distribution Atwood Cay, Bahamas (Coll Dr M A Howe)

Illustrations Cleve, Vega-Exp Iaktt 3 pl 37, f 62, A Schmidt, Atlas, pl 211, f 9

Species Unclassified or Doubtful

Plagiogramma ? mutuum A. Schmidt, Atlas, pl 209, f 15 A small form with an elevation in the centre Valve view unknown. Resembles a *Glyphodesmis*. Campeche Bay

Plagiogramma informe A Schmidt, Atlas, pl 211, f. 16–18. Valves linear-elliptical, constricted in the middle Two central and two terminal costae Pseudoraphe distinct, Campeche Bay

56 OPEPHORA P Petit Miss. Sci Cap Horn Bot 130 1888

Frustules rectangular. Valves cuneiform or linear-elliptical to lanceolate, with large, elliptical striae "*en forme de boutonnières*" near the margin Pseudoraphe or hyaline space distinct or broad. The structure of the striae clearly separates this genus from *Fragilaria*

Type species, *Fragilaria schwartzii* Grun

Valves linear-oblong or slightly clavate	1 *O pacifica*
Valves linear, elongate, slightly clavate	2 *O schwartzii*
Valves lanceolate	3 *O pinnata*
Valves ovate	4 *O martyi*

1 **Opephora pacifica** (Grun.) P Petit Miss Sci Cap Horn Bot 131 1888
Fragilaria pacifica Grun, Verh Zool-Bot Ges Wien 12 373 1862

Valves linear-oblong or slightly clavate, with rounded apices. Pseudoraphe linear, narrow. Costae broad, punctate, 3–6 in 10 µ. L of v 30 µ

Type locality· North Pacific Ocean

Distribution Marine Pacific Coast

Illustrations Verh Zool-Bot Ges Wien 12 pl 5, f 19, Van Heurck, Syn Diat Belg pl 44, f 20–22, Boyer, Diat. Phila pl 10, f 18

A triangular form occurs fossil in a deposit at Basalt, Nevada

2 **Opephora schwartzii** (Grun) P Petit in Pelletan, Les Diatomées, 2: 88 1889
Fragilaria schwartzii Grun, Verh Zool-Bot Ges. Wien 13 143 1863

Valves linear, elongate, slightly clavate, rounded at the apices. Costae broad, 4 in 10 µ. L. of v to 178 µ

Type locality· Brazil

Distribution Marine Caribbean Sea Pacific Coast.

Illustrations Verh Zool-Bot Ges Wien 13 pl 5, f 7, Van Heurck, Syn Diat Belg pl 44, f 24, Boyer, Diat Phila pl 10, f 16, 19

3 **Opephora pinnata** (Janisch & Rab.) P Petit Miss. Sci Çap Horn Bot 131 1888
Fragilaria pinnata Janisch & Rab, in Rab Beitr Alg 1 8 1863
Fragilaria pinnata Ehrenb? The figures in Mikrogeol, pl 6, 1, f 45 and pl 39, 2, 57, 58, are too inadequate for identification.

Valves lanceolate, with rounded apices. Pseudoraphe lanceolate. Costae broad. L. of v. 40 µ. Near *O. schwartzii*

Type locality Peruvian guano.

Distribution· Marine Honduras.

Illustrations Janisch & Rab, in Rab Beitr Alg 1. pl 2, f 18, Janisch, Abh Schles Ges Naturw-med Abth, pl 1 A, f 29, 1862

4 **Opephora martyi** Heribaud Diat Foss Auvergne, 1 43 1902

Valves ovate Costae broad, 6 in 10 µ Pseudoraphe narrow L of v 17–30 µ

Type locality Miocene deposit of Neussargues, Cantal, France

Distribution Fresh water Black River, Mich. Common

Illustrations Heribaud, Diat Foss Auvergne, 1 pl 8, f 20

(b) FRAGILARIINAE

1 *Fragilaria* Frustules rectangular, usually in filaments. Valves without costae or nodules Striae transverse, finely punctate, as a rule

2 *Rhaphoneis* Frustules rectangular, free or geminate Valves with striae frequently radiate and coarsely punctate

3 *Trachysphenia* Frustules rectangular, free Valves usually cuneiform

4 *Cymatosira* Frustules in fasciae, tumid in the middle Valves lanceolate

5 *Dimerogramma* Valves with smooth apices and broad pseudoraphe

6 *Glyphodesmis* Valves with a central nodule

7 *Synedra* Valves elongate, with transverse striae and distinct pseudoraphe

8 *Pseudosynedra* Valves as in *Synedra*, but oar-shaped

9 *Campylostylus* Valves arcuate, clavate, inflated

10 *Asterionella* Frustules and valves inflated at the ends, often in radiating clusters

11 *Thalassiothrix* Frustules radiating Valves arcuate

12 *Clavicula* Valves elongate, inflated at each end, usually with two lateral areas Striae punctate, irregular

57 **FRAGILARIA** (Lyngb) Ag Syst Alg 7 1824 Em Rab Fl Eur 1 118 1864

Frustules rectangular, usually in fasciae or long filaments, at length becoming free Valves without costae, symmetrical, transversely striated

Type species, *Fragilaria pectinalis* Lyngb

Brun divides the genus into two subgenera as follows

Eu-Fragilaria Valves not tumid in the middle, with a narrow or indistinct pseudoraphe Chromatophores granular

Staurosira Valves tumid in the middle, usually lanceolate, with a distinct pseudoraphe Chromatophores placcochromatic

As there is some doubt as to the number and position of the chromatophores in certain species of the two sections the division is provisional

EU-FRAGILARIA

Valves linear or linear-elliptical, attenuated at the ends	1. *F virescens*
Valves linear, slightly inflated at the ends	2 *F hyalina*
Valves oblong or elliptical, rounded at the ends	3 *F. arctica*
Valves linear-elliptical, rounded at the ends	4 *F oceanica*
Valves linear-oblong, obtuse at the ends	5 *F exilis*
Valves linear, rounded at the ends	6. *F. linearis*
Valves oblong-elliptical, obtuse at the ends	7 *F californica*
Valves lanceolate, obtuse, constricted at the ends	8 *F. striatula*
Valves lanceolate, slightly produced	9 *F capensis*
Valves linear Striae not interrupted	10 *F ? cylindrus*

STAURORISA

Valves lanceolate, produced, rounded at the ends	11 *F crotonensis*
Valves linear, with subrostrate ends	12 *F capucina*
Valves elliptical-lanceolate, with produced ends	13 *F construens*
Valves lanceolate, tumid in the middle	14 *F bidens*
Valves rhombic-lanceolate, sometimes constricted	15 *F parasitica*
Valves linear, elliptical or lanceolate, cuneate or acuminate at the ends	16 *F mutabilis*
Valves oblong-elliptical, with produced ends, sometimes constricted in the middle or truncate	17 *F undata*
Valves cruciform, with rounded angles.	18 *F harrisonii*
Valves linear, attenuate-rostrate at the ends	19 *F mormonorum*
Valves lanceolate Striae marginal	20 *F brevistriata*

1 **Fragilaria virescens Ralfs Ann & Mag Nat Hist 12 110 1843**

Fragilaria aequalis Heiberg, Consp Diat , 61 1863

Frustules quadrangular, elongate, united in long filaments. Valves linear or linear-elliptical, attenuated at the apices, obtuse, transversely striated, the striae 17 in 10 µ, punctate Pseudoraphe indistinct L of v 20–80 µ

Type locality Europe

Distribution Fresh water Common.

Illustrations Ralfs, Ann & Mag Nat Hist 12, pl. 2, f. 6, Kütz. Bac , pl 16, f 4; Heiberg, Consp Diat , pl. 4, f. 12, Brun, Diat. Alpes, pl 4, f 12, Van Heurck, Syn. Diat Belg , pl 44, f. 1, Boyer, Diat Phila , pl. 10, f. 20, 21, H. L Smith, T S. 170.

Fragilaria virescens producta (Lagerst) De-Toni, Syll. Alg 2: 682. 1892. *Fragilaria aequalis producta* Lagerst., Bih. Sv. Vet.-

Akad. Handl 1^{14} 15 pl 1, f 1 1873, Van Heurck, Syn Diat Belg, pl. 44, f 7 Valves with produced ends Striae 13–15 in 10 μ L of v. 25–52 μ Fresh water Alaska

2 **Fragilaria hyalina** (Kütz) Grun Verh Zool-Bot Ges Wien 12 374 1862
Diatoma hyalinum Kütz, Bac, 47 1844
Diatoma vitraeum Kütz, Bac 47 1844

Valves linear, slightly inflated at the ends, hyaline Striae very subtle, 30–32 in 10 μ Terminal pseudonodules distinct Frustules narrow, elongated, truncate at the ends L of v 45–75 μ

Type locality Adriatic Sea

Distribution Marine Atlantic Ocean

Illustrations Kütz, Bac, pl 17, f 20, W Smith, Syn Brit Diat 2 pl 41, f 312 (not a), Van Heurck, Syn Diat Belg, pl, 44, f. 15, H L Smith, T S 135

3 **Fragilaria arctica** Grun in Cleve & Grun, Sv Vet-Akad Handl II 17^2 110 1880

Frustules quadrangular, in short filaments Valves oblong or elliptical, rounded at the ends Striae subtle, 13 in 10 μ, with coarser puncta on the margin more evident in zone view L of v. 10–25 μ Cleve notes the presence of internal septa as in *Diatoma*.

Type locality Arctic Sea

Distribution Marine Atlantic Coast Campeche Bay

Illustrations Cleve & Grun, Sv Vet-Akad Handl II 17^2, pl 7, f. 124, Boyer, Diat Phila, pl 10, f 22, 23

4. **Fragilaria oceanica** Cleve Bih Sv Vet Akad Handl 1^{13} 22 1873

Frustules quadrangular, in long filaments Valves linear-elliptical, rounded at the ends Striae marginal, 11 in 10 μ L. of v. 24 μ Internal cells are formed as in *F arctica*

Type locality Arctic Sea

Distribution Plankton Davis Strait

Illustrations Cleve, Bih Sv Vet-Akad Handl 1^{13} pl 4, f 25. Grun., Denks. Akad Wien 48 pl 2, f 14

5 **Fragilaria exilis** Grun., Verh Zool Bot Ges Wien 13 144 1863

Frustules quadrangular, in short filaments Valves linear-oblong, obtuse at the ends Striae very subtle, 18 in 10 μ L. of v 5–11 μ (Grun).

Type locality West Indies

Distribution Known only from the type locality

Illustrations· Grun., Verh. Zool-Bot. Ges. Wien 13. pl. 4 (13), f 21.

6. **Fragilaria linearis** Castr, Rep Voy Chall. Bot. 2 56 1886

Frustules linear, in filaments Valves linear, rounded at the ends. Pseudoraphe indistinct Striae about 20 in 10 μ. L of v. 30–40 μ.

Type locality. Antarctic Sea.

Distribution Marine Atlantic Coast

Illustrations Castr, Rep Voy. Chall Bot. 2 pl 19, f. 9, Boyer, Diat Phila, pl 10, f 37.

7 **Fragilaria californica** Grun., in Van Heurck Syn Diat Belg, pl 44 1881

Frustules in very long filaments, quadrangular Valves oblong-elliptical, obtuse at the ends Striae about 16 in 10 µ In zone view the frustules are longitudinally finely striated L. of v. 35 µ.

Type locality California

Distribution Marine Common in Monterey Bay, Cal

Illustrations Van Heurck, Syn Diat Belg, pl 44, f 13

8 **Fragilaria striatula** Lyngb, Tent Hydrophyt Dan 183 1819
Grammonema striatulum (Lyngb) Ag Consp Crit Diat, 63 1832
Grammonema juergensii Ag, Consp Crit Diat, 63 1832
Not *Fragilaria striatula* Grev which is *Rhabdonema minutum*

Frustules quadrangular, in long filaments, not separating, scarcely siliceous Valves lanceolate, obtuse, constricted at the ends Pseudoraphe not evident Striae subtle, evident in zone view on the edges of the valve, 20–24 in 10 µ L of v 25–45 µ

Type locality Faroës

Distribution Marine Greenland California Mt Desert Is., Maine

Illustrations Lyngb, Tent Hydrophyt Dan, pl 63, A, Ralfs, in Pritchard, Infusoria, pl 15, f 24, 25, W Smith, Syn Brit. Diat. 2. pl. 35, f. 298; H L. Smith, T S 168, 672

On account of the imperfectly siliceous character of this species it has been included by some authors in the Desmidiaceae Compare, however, the remarks of W. Smith, Syn Brit Diat 2. 23. 1856 According to Karsten there is but one chromatophore which lies on the zone, and, consequently, the species should, probably be placed in the next section

9 **Fragilaria capensis** Grun Verh Zool-Bot Ges. Wien 13 143 1863

Frustules linear, in short fasciae Valves lanceolate, with slightly produced ends Striae 13–15 in 10 µ, interrupted by a narrow pseudoraphe L of v 15–30 µ.

Type locality Cape of Good Hope

Distribution Marine Charlton Island, Hudson Bay.

Illustrations Grun., Verh. Zool.-Bot Ges. Wien 13: pl. 5 (14), f. 5, Van Heurck, Syn. Diat. Belg, pl. 44, f. 19.

14. **Fragilaria ? cylindrus** Grun., Denks Akad Wien 48 107 1884

Frustules in short chains or fasciae. Valves linear or linear-elliptical, with rounded ends. Striae not interrupted, 14–22 in 10 μ. L of v 6–32 μ.

Type locality Franz Josephs Land

Distribution Marine East coast of Greenland

Illustrations Grun, Denks Akad Wien 48' pl 2 (B), f 13.

11 **Fragilaria crotonensis** Kitton Science Gossip 5 110 1869
Nitzschia pecten Brun, Diat Alpes, 109 1880

Frustules linear-lanceolate, inflated in the middle and truncate at the apices, united at the middle part in filaments Valves lanceolate, produced, rounded at the apices Striae subtle, 22 in 10 μ L of v 40–110 μ

Type locality Croton River, N Y

Distribution Fresh water Lake Erie, at Buffalo Lake Michigan

Illustrations Kitton, Science Gossip 5 110, f 81, Brun, Diat. Alpes, pl 5, f 30, pl. 9, f 27, H L Smith, T S 166, A Schmidt, Atlas, pl 299, f 1–8

Fragilaria crotonensis prolongata (Grun) *Synedra crotonensis prolongata* Grun, in Van Heurck, Syn Diat. Belg, 156, 1885, pl. 40, f 10 1881 Valves very narrow, apices not capitate L of v 100 μ Lake Michigan

12 **Fragilaria capucina** Desmaz Plantes Crypt France No 453 1825
Fragilaria pectinalis Lyngb (not Ehrenb) Tent Hydrophyt Dan, 184 1819

Frustules linear, in long filaments Valves linear, with subrostrate apices. Striae 15 in 10 μ L of v 15–115 μ

Type locality France

Distribution Fresh, sometimes brackish water Common

Illustrations Lyngb, Tent Hydrophyt Dan, pl 63, D, Kütz., Bac., pl 16, f. 3, Van Heurck, Syn Diat Belg, pl 45, f 2, Brun, Diat Alpes, pl 4, f 1, H L Smith, T S 165

Fragilaria capucina mesolepta Rab, Fl Eur 1 118 1864. Valves constricted in the middle Striae 17–18 in 10 μ Van Heurck, Syn Diat. Belg., pl 45, f. 3, Boyer, Diat Phila, pl 10, f 34, H L Smith, T S 167 With the type

Fragilaria capucina acuta Grun, in Van Heurck, Syn Diat. Belg., pl 45, f. 4 Valves narrowly lanceolate, with acute apices. With the type

Fragilaria capucina acuminata Grun, in Van Heurck, Syn. Diat Belg., pl 45, f 8 Valves narrow, lanceolate; apices rostrate, produced. Striae 18 in 10 μ, with the type

13 **Fragilaria construens** (Ehrenb) Grun Verh Zool Bot Ges Wien 12: 371 1862
Staurosira construens Ehrenb , Abh Akad Berlin, 424 1841
Odontidium Tabellaria W Smith, Syn Brit Diat 2 17 1856
Dimerogramma tabellaria (W Smith) Ralfs, in Pritchard, Infusoria, 790 1861

Valves elliptical-lanceolate, with produced apices, sometimes constricted in the middle Pseudoraphe lanceolate Striae 15–20 in 10 μ L of v 10–45 μ Extremely variable in outline The numerous figures in Mikrogeol are, for the most part, representations of var *genuina* (Ehrenb) Grun

Type locality North America

Distribution Fresh water Common

Illustrations Ehrenb , Mikrogeol , pl 5, 2, f 23, a–g, pl 6, 1, f. 44, a, b, and others, Grun , Verh Zool -Bot. Ges. Wien. 12 pl 4, f 10, W Smith, Syn Brit. Diat 2 pl 34, f 291 a; Pritchard, Infusoria. pl. 15, f 5, Boyer, Diat Phila , pl 10, f 30; H L. Smith, T S 140

Fragilaria construens binodis (Ehrenb) Grun , Verh Zool.-Bot Ges. Wien 12 371 1862 *Fragilaria binodis* Ehrenb , Mikrogeol ; pl 5, 2, f 26 Valves constricted in the middle W Smith, Syn Brit Diat 2 pl 34, f. 291, B With the type

14 **Fragilaria bidens** Heiberg Consp Diat 60 1863

Frustules rectangular Valves lanceolate, tumid in the middle, constricted at the ends, subcapitate Pseudoraphe broad Striae 18 in 10 μ L of v 30–50 μ

Type locality Denmark

Distribution Fresh water Swan River, Oregon (Fossil?)

Illustrations Heiberg, Consp Diat pl 5, f 14, Van Heurck, Syn Diat Belg , pl 45, f 6

15 **Fragilaria parasitica** (W Smith) Heiberg, Consp Diat 62 1863
Odontidium parasiticum W Smith, Syn Brit Diat 2 19 1856

Frustules solitary or geminate. Valves rhombic-lanceolate, sometimes constricted, with produced, subcapitate apices Pseudoraphe broad, lanceolate. Striae subtle, about 20 in 10 μ. L of v. 20 μ

Epiphytic on other diatoms, particularly upon *Nitzschia*, *Surirella* and *Synedra* *Fragilaria construens binodis* (Ehrenb) Grun. is sometimes given as a constricted variety of this form. It is distinguished from other *Fragilaria* not only because of its epiphytic habit but because it is not found in filaments

Type locality Scotland.

Distribution Fresh water. Local Media, Penna. (Coll. T. C. Palmer).

Illustrations W. Smith, Syn. Brit Diat 2 Suppl pl 60, f. 375; Boyer, Diat Phila., pl 10, f 35

16 **Fragilaria mutabilis** (W Smith) Grun Verh Zool-Bot. Ges Wien 12 369 1862
Odontidium mutabile W Smith, Syn Brit Diat 2 17 1856

Frustules in long filaments Valves linear, elliptical or lanceolate, cuneate or acuminate at the ends Striae short, 6–9 in 10 µ L. of v 10 µ or more Quite variable in outline and length

Type locality England

Distribution Fresh water Local Media, Penna Richmond, Va.

Illustrations W Smith, Syn. Brit Diat 2 pl 34, f 290, H L. Smith, T. S 692

17 **Fragilaria undata** W Smith Syn Brit. Diat 2 24 1856

Frustules in filaments, frequently attached by the angles Valves oblong-elliptical, with produced ends, frequently constricted in the middle or triundulate Pseudoraphe evident Striae subtle, 17 in 10 µ, evident on the margin Terminal puncta distinct L of v 20–35 µ Quite variable in outline Resembles the sporangial forms of *Fragilaria construens* (Ehrenb) Grun in outline

Type locality Scotland

Distribution Fresh water Mays Landing, N J (Coll F J Keeley)

Illustrations W. Smith, Syn Brit Diat 2 Suppl pl 60, f 377, Boyer, Diat Phila, pl 10, f 24, 25, 27, 29, H L Smith, T S 661.

18 **Fragilaria harrisonii** (W Smith) Grun, Verh Zool-Bot Ges Wien 12 368 1862
Odontidium harrisonii W Smith, Syn Brit Diat 2 18 1856
Staurosira harrisonii (W Smith) Cleve, Sv Vet-Akad Handl (2) 17^2 9 1880

Frustules in very short filaments or free Valves cruciform, with rounded angles Pseudoraphe lanceolate, narrow Striae robust, 6 in 10 µ, radiating in the middle, composed of confluent puncta, larger at the border L of v 30 µ Varies in outline to elliptical or elliptical-lanceolate This form is to be considered as doubtfully belonging to the genus

Type locality England

Distribution. Fresh water Generally distributed Abundant in Elkton Lithia Springs, Va.

Illustrations W. Smith, Syn. Brit. Diat 2: Suppl, pl. 60, f 373, 374; Boyer, Diat Phila, pl. 10, f. 31, H. L Smith, T. S. 380.

19 **Fragilaria mormonorum** (Grun)
Fragilaria brevistriata mormonorum Grun. in Van Heurck, Syn Diat Belg, pl 45 1881

Frustules in filaments. Valves linear, attenuate-rostrate at the ends. Striae short, 18 in 10 µ. L. of v. 40 µ.

Type locality Salt Lake, Utah

Distribution Salt water Known only from the type locality.

Illustrations Van Heurck, Syn Diat. Belg , pl. 45, f. 31.

20. **Fragilaria brevistriata** Grun , in Van Heurck Syn Diat Belg , 157 1885

Valves lanceolate, slightly rostrate Striae marginal, 13–14 in 10 µ L. of v. 10–20 µ

Type locality Belgium

Distribution Fresh water. Bristol, Conn Weequachick Lake, N J

Illustrations Van Heurck, Syn Diat Belg , pl 45, f 32, A. Schmidt, Atlas, pl 307, f 10–14

58 **RHAPHONEIS** Ehrenb Ber Akad Berlin 74 1844

Frustules linear, narrow Valves elliptical or lanceolate Striae transverse, more or less radiating, moniliform. Pseudoraphe usually narrow

Type species, *Rhaphoneis amphiceros* Ehrenb

Valves lanceolate, broad, with produced ends	1 *R amphiceros**
Valves lanceolate, narrow, with produced ends.	2. *R belgica*
Valves constricted in the middle, the segments three-lobed	3. *R castracanei*
Valves lanceolate Striae marginal	4. *R. marginulata*

1 **Rhaphoneis amphiceros** Ehrenb., Ber Akad Berlin 87 1844

Doryphora amphiceros Kütz , Bac , 74 1844

Valves lanceolate, broad, with produced ends Striae moniliform, radiating, about 6 in 10 µ, the granules in longitudinal lines L of v. 35–70 µ.

Type locality Europe

Distribution Marine Atlantic Coast

Illustrations Ehrenb , Mikrogeol , pl 18, f. 82, Kütz., Bac , pl 5, f 10, pl 21, 2, f 1 (?), W Smith, Syn. Brit. Diat 1. pl 24, f. 224, Van Heurck, Syn Diat Belg , pl 36, f. 22, 23, Boyer, Diat. Phila , pl 10, f 38.

Rhaphoneis amphiceros tetragona Grun , A. Schmidt, Atlas, pl. 294, f. 33, 34, from the Indian Ocean, appears to be the same as *Amphitetras crucifera* Kitton, Science Gossip 3. 271, f 285. 1867, from the West Indies, in which the outline is quadrate and the pseudoraphe is double and cruciform

2 **Rhaphoneis belgica** Grun., in Van Heurck, Syn. Diat. Belg., pl 36. 1881

Valves lanceolate, narrow, with produced ends. Striae scarcely radiating, 6–7 in 10 µ, the granules in straight, longitudinal lines. L. of v. 70 µ.

Type locality Belgium

Distribution· Marine Atlantic Coast.

Illustrations Van Heurck, Syn. Diat Belg, pl 36, f 25, 29.

Rhaphoneis belgica intermedia Grun, in Van Heurck, Syn Diat Belg., pl 36, f 30 1881 Valves with more produced ends than in type. Striae about 6 in 10 µ Atlantic Coast Boyer, Diat. Phila., pl 10, f 41

3 **Rhaphoneis castracanei** Grun, in Van Heurck Syn Diat Belg pl 36 1881
Rhaphoneis amphiceros castracanei (Grun) Cleve, Vega-Exp Iaktt 3 499 1883

Valves constricted in the middle, the segments three-lobed, forming a hexagonal outline, with concave sides, and rounded angles Striae transverse in the middle, arcuate toward the ends, moniliform, about 7 in 10 µ Pseudoraphe narrow, disappearing at the ends. L of v 35 µ In some specimens a branch of the pseudoraphe extends to an angle and the form approaches *Amphitetras crucifera* Kitton (See under *R amphiceros*)

• *Type locality* Samoa

Distribution Marine Ormond, Florida.

Illustrations Van Heurck, Syn Diat Belg, pl 36, f 28, A Schmidt, Atlas, pl 294, f 35–37

4 **Rhaphoneis marginulata** Cleve & Grun in Cleve Vega-Exp Iaktt. 3 500 1883

Valves lanceolate Striae radiate, lineate, about 10 in 10 µ, somewhat coarser in the middle, marginal, extending to one-third the diameter of the valve Pseudoraphe or axial area hyaline, lanceolate L of v. 52 µ Cleve's form is said to have striae 15 in 10 µ and the length 42 µ

Type locality Labuan

Distribution Marine Campeche Bay

Illustrations Cleve, Vega-Exp Iaktt. 3 pl 37, f 57.

59 **TRACHYSPHENIA** P Petit, Fonds Mer 3 190 1877

Frustules rectangular Valves cuneiform or elliptical-lanceolate, with rounded ends Striae transverse, moniliform, the granules in longitudinal rows Pseudoraphe linear, narrow

Type species, *Trachysphenia australis* P. Petit

1 **Trachysphenia australis** P Petit, Fonds Mer 3 190. 1877

Not *Rhaphoneis australis* H. L. Smith, Amer Quart. Jour. 1. 14 1878, which is *Trachysphenia aucklandica* Grun.

Characters of the genus. Striae about 6 in 10 µ. L of v. 32 µ

Type locality Ile Campbell.

Distribution. Marine. Shark River, N. J.

Illustrations P. Petit, Fonds Mer 3 pl 5, f 19; Jour Roy. Micr Soc 1 pl 15, f 19, Boyer, Diat Phila, pl 12, f 15

60 **CYMATOSIRA** Grun, Verh Zool-Bot Ges. Wien 12 377 1862

Frustules tumid in the middle in zone view, closely united in fasciae Valves lanceolate, punctate Pseudoraphe absent

Type species, *Cymatosira lorenziana* Grun

1 **Cymatosira lorenziana** Grun Verh Zool Bot Ges Wien 12 378 1862

Valves broadly lanceolate, with produced apices Striae transverse, 9–10 in 10 μ, puncta decussate L. of v 25–27 μ

Type locality Adriatic Sea

Distribution Marine Yucatan. Common Savannah, Ga

Illustrations· Grun, Verh Zool-Bot Ges Wien 12 pl 4, f 25. Van Heurck, Syn Diat Belg, pl. 45, f 42.

61 **DIMEROGRAMMA** Ralfs, in Pritchard, Infusoria 790 1861

Frustules quadrangular, adnate in short fasciae or free, constricted near the ends Valves linear, elliptical or lanceolate, transversely striated, the striae punctate Pseudoraphe usually broad or distinct Without central nodule Apices usually appearing smooth

Type species, *Denticula minor* Greg

Dimerogramma, *Glyphodesmis*, and *Plagiogramma* are connected by intermediate forms *Dimerogramma* is without a central nodule but *D marinum* and *Glyphodesmis williamsonii* are related through *Glyphodesmis tumida* *Plagiogramma* is distinguished from *Glyphodesmis* by the presence of costae but is related through *P tessellatum* and *P papilio* Certain forms of *Dimerogramma* are also very near *Fragilaria* and *Rhaphoneis*

Valves narrow, lanceolate, slightly tumid in the middle, tapering at the ends Pseudoraphe narrow	1 *D. fulvum*
Valves rhombic-lanceolate Pseudoraphe lanceolate	2. *D. minus*
Valves rhombic-lanceolate Pseudoraphe indistinct	3 *D intermedium*
Valves linear, tumid in the middle Pseudoraphe widened in the middle	4. *D. marinum*
Valves linear-elliptical Pseudoraphe bifurcate at ends	5. *D. furcigerum*
Valves linear, inflated in the middle. Pseudoraphe broad, not widened in the middle.	6. *D. inflatum*
Valves lanceolate-elliptical, inflated in the middle Pseudoraphe widened in the middle	7. *D. ventricosum*

Valves broadly elliptical. Pseudoraphe narrow, dilated at the ends	8. *D surirella*
Valves elliptical Pseudoraphe broad, constricted in the middle	9 *D. australe*

1 **Dimerogramma fulvum** (Greg) Ralfs, Pritchard Infusoria 790 1861
Denticula fulva Greg, Trans Roy Soc. Edinb 21 496 1857

Valves lanceolate, narrow, slightly tumid in the middle, tapering at the ends Pseudoraphe narrow expanding at the centre to a small, orbicular space Striae moniliform, slightly radiating at the ends, 10 in 10 µ L of v 56 µ.

Type locality Scotland

Distribution Marine. Campeche Bay

Illustrations Greg, Trans Roy Soc Edinb 21 pl 10, f 38.

2 **Dimerogramma minus** (Greg.) Ralfs Pritchard Infusoria, 790 1861
Denticula minor Greg, Trans Roy Soc Edinb, 21 495 1857

Valves rhombic-lanceolate Pseudoraphe lanceolate. Apices smooth Striae radiate, punctate, about 6 in 10 µ L of v 10–20 µ

Type locality Scotland.

Distribution Marine Atlantic Coast

Illustrations· Greg, Trans Roy Soc Edinb, 21 pl 10, f 35; Van Heurck, Syn Diat Belg, pl. 36, f 10, 11 a, Boyer, Diat Philadelphia, pl 12, f 12–14.

3 **Dimerogramma intermedium** Boyer Bull Torr Club 47 67 1920

Valves rhombic-lanceolate Pseudoraphe indistinct Striae 10 in 10 µ, moniliform Apices indistinctly punctate L of v 35 µ Apparently intermediate between *D fulvum* and *D minus*

Type locality Campeche Bay

Distribution. Marine Known only from the type locality

Illustrations Bull Torr Club, 47 pl 2, f 11

4 **Dimerogramma marinum** (Greg) Ralfs, Pritchard, Infusoria, 790 1861
Denticula marina Greg, Trans Roy Soc Edinb 21 496 1857

Valves linear, tumid in the middle, subconical and rounded at the ends Pseudoraphe widened in the middle, disappearing toward the apices Striae transverse, slightly radiate at the ends, moniliform, about 8 in 10 µ (acc. to Greg 4) L of v 55–200 µ Variable in outline, size and striation

Type locality Scotland.

Distribution Marine. Atlantic Coast, southward.

Illustrations. Greg, Trans. Roy Soc Edinb, 21. pl 10, f 39, Van Heurck, Syn. Diat. Belg., pl 36, f. 9.

5 **Dimerogramma furcigerum** Grun, Van Heurck, Syn Diat Belg pl. 36. 1881

Valves linear-elliptical, with produced and rounded ends.

Striae transverse, 15 in 10 μ, the moniliform puncta in longitudinal rows Pseudoraphe very narrow, not evident in the middle, bifurcate at each end, showing a dark line of puncta between the forks L of v 70 μ Varies slightly in outline from Van Heurck's figure of a Mediterranean form

Type locality Mediterranean Sea

Distribution Marine Campeche Bay.

Illustrations Van Heurck, Syn Diat Belg, pl 36, f. 8

6. **Dimerogramma inflatum** Mann, Contr U S Nat Herb 327 1907

Valves linear, inflated in the middle, with ends tapering to a rounded process Pseudoraphe broad, not widened in the middle. Striae transverse, moniliform, the puncta decreasing in size toward the middle, about 8 in 10 μ L of v 86 μ (Mann in part)

Type locality Gulf of California

Distribution Marine Known only from the type locality

Illustrations Mann, Contr U S Nat Herb, pl 44, f 6

7 **Dimerogramma ventricosum** (Janisch & Rab) Grun Hedwigia 6 2 1867

Denticella ventricosa Janisch & Rab in Rab, Beitr Alg 1 8 1863

Valves lanceolate-elliptical, inflated in the middle, with subconical, obtuse ends Striae transverse, moniliform, about 8 in 10 μ. Pseudoraphe widened in the middle, disappearing toward the ends L of v 30 μ

Type locality Honduras

Distribution Marine Virgin Islands Campeche Bay

Illustrations Rab Beitr. Alg. 1 pl. 2, f. 11

8 **Dimerogramma surirella** (Ehrenb) Grun. Cleve Bih Sv Vet.-Akad Handl 5^4 11 1878

Zygoceros surirella Ehrenb, Abh Akad Berlin, pl 4, f 12 1840?

Rhaphoneis Rhombus Grun, Verh Zool-Bot Ges Wien 12 381 1862

Valves broadly elliptical or elliptical-lanceolate, rounded at the ends Pseudoraphe linear, narrow, dilated at the apices. Striae slightly radiating, about 9 in 10 μ L of v. 25–60 μ

Type locality Ostend.

Distribution Marine. West Indies.

Illustrations Grun, Verh Zool-Bot. Ges Wien 12 pl. 4, f. 36; Van Heurck, Syn Diat Belg., pl 36, f 26, 27 A

9 **Dimerogramma australe** (P Petit)

Dimerogramma surirella australis P Petit, Van Heurck, Syn Diat Belg. pl. 36 1881

Rhaphoneis fasciolata australe P Petit, Fonds Mer 3 171. 1877.

Valves elliptical. Pseudoraphe broad, slightly constricted in the middle. Striae radiate at the ends, 7 in 10 μ, coarsely punctate. L. of v 28–88 μ

Type locality. New Zealand.

Distribution· Marine Caribbean Sea Yucatan

Illustrations P. Petit, Fonds Mer 3. pl 4, f 6, Van Heurck, Syn Diat Belg., pl 36, f 27 B, Jour Roy Micr Soc 1 pl 14, f 6

62 GLYPHODESMIS Grev, Quart Jour Micr Sci 10 234 1862

Frustules quadrangular, adnate in short fasciae or free Valves lanceolate or elliptical, striated, the striae punctate Pseudoraphe distinct Central and terminal nodules

Type species, *Diadesmis williamsonii* Greg

Pseudoraphe widened in the middle to an orbicular space.	1 *G eximia*
Pseudoraphe broad, lanceolate	2. *G campechiana*
Pseudoraphe distinct, lanceolate in the middle	3 *G tumida*

1 Glyphodesmis eximia Grev Quart Jour Micr Sci 10 235 1862

Valves elliptical to linear-elliptical, with rounded or subacute ends Pseudoraphe distinct, widened in the middle, in larger forms, to an orbicular space surrounding a large umbonate pseudonodule Striae radiate, 4 in 10 µ, interrupted by one or more longitudinal lines forming quadrate cells each of which contains fine puncta arranged usually in groups of four. Terminal spaces elliptical or triangular, hyaline L of v 38–75 µ

Type locality Nassau, Bahamas

Distribution Marine Jamaica Virgin Islands Key Biscayne, Fla

Illustrations Grev, Quart Jour. Micr Sci 10 pl 10, f 7–10; A. Schmidt, Atlas, pl 210, f 9–18

2 Glyphodesmis campechiana Boyer Bull Torr Club 47 68 1920

Valves linear-lanceolate, tumid in the middle and tapering to the subacute ends Central pseudonodule distinct, terminal spaces ovate. Striae marginal, 12 in 10 µ, leaving a broad, lanceolate, hyaline area about one-half the width of the valve L of v. 30 µ.

Differs from *G. distans* in outline. It is not var *minor* Van Heurck.

Type locality Campeche Bay.

Distribution Marine Known only from the type locality.

Illustrations Bull. Torr Club 47. pl. 2, f. 10

3. Glyphodesmis tumida Boyer Bull Torr Club 47 68 1920

Valves linear, with subacute ends, tumid in the middle Central and terminal nodules distinct. Pseudoraphe distinct, expanded into a lanceolate space at the centre Striae slightly radiating at the ends, moniliform, 9 in 10 µ. L. of v. 95 µ

Resembles *Dimerogramma marinum* in outline but differs in possessing a central nodule and finer striation. It differs from *G. williamsonii* (Greg.) Grun in outline and somewhat resembles *Plagiogramma locsyi* Pant, Foss Bac. Ungarns, 3: pl 18, f. 266.

Type locality · Campeche Bay

Distribution Marine Known only from the type locality.

Illustrations Bull. Torr Club 47 pl 2, f 2

63 SYNEDRA Ehrenb Ber Akad Berlin, 1830 40 1830

Frustules stipitate, single or adnate in small clusters, becoming free, or rarely not stipitate, in bundles. Valves elongate, linear or linear-lanceolate Pseudoraphe distinct. Costae absent. Striae transverse, moniliform or punctate, sometimes subtle Chromatophores vary in number and position. In fresh-water forms the chromatophores are in bands, while in the marine species they are in numerous rounded discs each containing a pyrenoid. In *S. ulna*, *S acus*, and *S. affinis* the bands are two, one on each valve. In the section *Ardissonia* the chromatophores are all round or oval granules or discs.

Type species, *Bacillaria ulna* Nitzsch

Synedra and *Fragilaria* are nearly allied In *Synedra* the frustules are in small clusters attached by stipes to various objects, except in certain marine species The length is much greater than the width, the pseudoraphe quite distinct and the striae usually coarse In *Fragilaria* the frustules are usually in long chains, the pseudoraphe is very narrow or indistinct, and the striae are fine Such forms as *F. parasitica* and *F harrisonii* are exceptions.

In the descriptions here given Van Heurck is followed in the identification of specimens as it is difficult, if not impossible, to determine many of the forms from Kützing's figures.

Van Heurck divides the genus into three sections as follows.

1. *Eusynedra* Valves regularly striated, scarcely or not at all inflated in the middle and usually without sulci or longitudinal lines

2 *Ardissonia* Valves usually with two or more longitudinal lines

3. *Toxarium.* Valves inflated in the middle and at the ends. Striae irregular

1. EUSYNEDRA

Striae reaching the pseudoraphe.	
Valves linear, with parallel sides.	
Ends rostrate.	2. *S. ulna*
Ends inflated	3. *S. splendens*
Ends attenuated	4. *S. aequalis*
Ends rostrate and constricted.	5 *S. amphirhynchus*

Ends rounded.	7. *S. obtusa*
Ends rostrate, produced.	10. *S vitraea*
Ends slightly rostrate. Pseudonodule excentric.	11 *S vaucheriae*
Ends rounded, inflated.	17 *S spathulifera*
Ends constricted and rounded. Valves elongated.	18 *S chaseana*
Ends subrostrate	19 *S oxyrhynchus*
Ends inflated and styliform	22 *S longiceps*
Ends capitate	23 *S capitata*
Valves linear, slightly incrassate in the middle. Striae subtle.	25. *S capillaris*
Valves linear, slightly widened in the middle. Extremely elongated	38 *S. thalassiothrix*
Valves lanceolate	
Pseudonodule well-defined, ring-like	1 *S. pulchella*
Pseudonodule excentric Valves rostrate	12 *S parvula*
Pseudonodule absent or not well defined	
Valves incised on both sides	13 *S incisa*
Valves constricted in the middle	14 *S goulardi*
Valves twice curved	8 *S bicurvata*
Valves acicular	15 *S acus*
Valves slender, capitate.	9 *S danica*
Valves very narrow, slightly capitate.	16. *S delicatissima*
Valves with obtuse, rounded ends	20 *S radians*
Valves narrow, subrostrate or subcapitate	21. *S familiaris*
Valves subrostrate Striae very subtle	24 *S laevigata*
Valves tapering to the obtuse ends.	26 *S gaillonii*
Valves attenuated to the rounded ends	27 *S investiens*
Valves with produced ends.	28 *S hyperborea*
Valves slender, subcapitate. Striae subtle.	32. *S laevis*
Valves inflated at the rounded ends Striae subtle	33 *S provincialis*
Valves very long, tapering, inflated at the ends.	6. *S. longissimae*
Valves elliptical-lanceolate, slightly rostrate.	34. *S barbatula*
Valves clavate.	37. *S. cuneata*
Striae marginal.	
Valves tapering to the obtuse ends.	29 *S. affinis*
Valves lanceolate, obtuse. Frustules tabulate.	31. *S tabulata*

Valves lanceolate, rostrate-capitate	30	*S parva*
Valves attenuated to the capitate ends	35	*S demerarae*
Valves linear-lanceolate, subcapitate.	36	*S kamtschatica*
Valves linear-lanceolate, rounded at the ends	39	*S nitzschioides*

1 **Synedra pulchella** (Ralfs) Kütz Bac 68 1844
Exilaria pulchella Ralfs, in Kütz, Bac, 68 1844
Ctenophora pulchella Bréb, acc to W Smith, Syn Brit Diat 1 70 1853

Frustules linear, narrowed at the ends, in flabellate clusters. Valves lanceolate, with rostrate or slightly capitate ends and a well defined ring-like pseudonodule Pseudoraphe distinct. Terminal pseudonodules small Transverse striae distinctly punctate, 13 in 10 μ. L of v to 120 μ

Type locality Europe

Distribution Fresh water Common in streams and ponds

Illustrations Kütz, Bac, pl 29, f 87, W. Smith, Syn. Brit. Diat 1 pl 11, f 84, A Schmidt, Atlas, pl 300, f 19–31, Boyer, Diat Phila, pl 11, f 14–16

Synedra pulchella abnormis Macchiati, N Giorn Bot Ital, 264. 1889 Valves with one end curved like a beak as in *S hamata* W Smith Schuylkill River, Philadelphia Boyer, Diat Phila., pl 11, f. 17

Synedra pulchella flexella Boyer, Diat Phila, 49 pl 12, f 2. 1916 Frustule slightly attenuated at the ends, truncate, somewhat tumid in the middle and flexed Valves lanceolate, with obtuse or subcapitate ends and two almost imperceptible constrictions at the middle Pseudoraphe distinct Central space sometimes hyaline Striae 14–16 in 10 μ. L of v 56 μ With the outline of *S. familiaris* Near Philadelphia Common

2 **Synedra ulna** (Nitzsch) Ehrenb. Inf 211 1838
Bacillaria Ulna Nitzsch, Beitr Inf, 99 1817

Frustules solitary or geminate Valves linear or linear-lanceolate with rostrate ends. Pseudoraphe distinct. Striae 9 in 10 μ. L of v to 250 μ The striae are frequently interrupted in the middle, leaving a hyaline quadrangular space

Type locality· Europe.

Distribution Fresh water Common

Illustrations: Nitzsch, Beitr. Inf pl. 5 (includes variations), W. Smith, Syn. Brit Diat. 1: pl 11, f. 90, Pritchard, Infusoria, pl. 10, f. 184, Van Heurck, Syn Diat. Belg., pl. 38, f. 7, A. Schmidt, Atlas, pls. 301, 302, Boyer, Diat. Philadelphia, pl. 11, f. 4, 7.

Brun remarks that it "is impossible to find characters sufficiently distinctive" to form species of a number of forms which are usually considered as varieties of *S ulna* As, however, there is much difference in the outline of these variations the following eleven forms are described under the original specific names In all of these the striae vary but slightly, the hyaline space may or may not be present and the valves are frequently distorted or curved. Sporangial forms of *S ulna*, as seen in actual formation, appear with distinctly spathulate ends Not all spathulate forms, however, are sporangial See A Schmidt, Atlas, pl. 304, Boyer, Diat Philadelphia, pl 11, f 1, 5, 6

3 **Synedra splendens** Kütz Bac 66 1844.

Frustules expanded at the truncate ends Valves linear, elongate, inflated at the rounded ends Striae 9 in 10 µ L of v. to 300 µ

Type locality Europe

Distribution Fresh water Generally distributed Not common

Illustrations Kütz, Bac, pl 14, f 16 (not exact); Brun, Diat. Alpes, pl 5, f 1, H L Smith, T S 577 The figure in Van Heurck, Syn Diat Belg, pl 38, f 2, corrected in *errata* from *S. longissima*, is not this form

4 **Synedra aequalis** Kütz Bac 66 1844

Frustules expanded at the truncate ends Valves linear, not elongate, with parallel sides and attenuated at the ends Striae 10–12 (?) in 10 µ L of v to 100 µ

Type locality Europe

Distribution Fresh water Generally distributed

Illustration Kutz, Bac, pl 14, f 14, Brun, Diat Alpes, pl 5, f 2, 3

5 **Synedra amphyrhynchus** Rab Suessw Diat 55 1853

Frustules not expanded at the ends Valves linear, with parallel sides, suddenly constricted to rostrate ends Striae 9–11 in 10 µ. L of v. 100–200 µ Near the type form of *S ulna*

Type locality Europe.

Distribution Fresh water Common.

Illustrations: Rab, Suessw Diat, pl 4, f. 7; Brun, Diat. Alpes, pl. 4, f. 25. Not Van Heurck, Diat. Belg., pl. 38, f. 5.

6. **Synedra longissima** W Smith, Syn. Brit Diat., 1 72. 1853

Valves very long, sometimes curved, gradually tapering to the rounded capitate or inflated ends. Striae 12 in 10 µ L. of v. to 550 µ.

Type locality: Ireland.

Distribution Fresh water Not common. Enfield, Conn Lake Michigan

Illustrations: W. Smith, Syn Brit. Diat., 1. pl. 12, f. 95; Brun, Diat Alpes, pl 4, f 21; Van Heurck, Syn. Diat Belg, pl 38, f 3; H. L. Smith, T S. 564, 565,

7 **Synedra obtusa** W Smith, Syn Brit Diat 1 71 1853

Valves linear, rounded at the ends Striae 10 in 10 µ. L of v. 100–200 µ.

Type locality England

Distribution: Fresh water Not uncommon.

Illustrations. W. Smith, Syn. Brit. Diat., 1: pl. 11, f. 92, Van Heurck, Syn. Diat Belg, pl. 38, f 6, H L Smith, T S 569 (?).

8 **Synedra bicurvata** Biene in Rab. Fl Eur 1: 120 1864

Valves twice curved in the middle, constricted toward the capitate-rostrate, produced ends Striae 8 in 10 µ L of v to 150 µ.

Type locality · Switzerland.

Distribution Fresh water. Delaware County, Penna. (T. C. Palmer)

Illustrations Meister, Kiesalg Schweiz, pl 6, f 20

9 **Synedra danica** Kütz, Bac, 66. 1844

Valves slender, narrowly lanceolate, dilated at the subcapitate ends Striae 10 in 10 µ L. of v. to 180 µ.

Type locality. Denmark

Distribution. Fresh water Generally distributed

Illustrations Kütz., Bac., pl 14, f. 13; Van Heurck, Syn Diat Belg, pl 38, f 14, a, b; H. L. Smith, T S 549.

10 **Synedra vitrea** Kütz Bac 66. 1844

Frustules expanded at the ends. Valves linear, narrow, with produced, rostrate, sometimes slightly capitate ends. Striae 10–11 in 10 µ L of v. to 150 µ

Type locality: France

Distribution · Fresh water Not common. Fall Mt., near Bristol, Conn Lake Michigan.

Illustrations. Kütz., Bac., pl 14, f. 17; Van Heurck, Syn. Diat. Belg., pl. 38, f. 12.

11 **Synedra vaucheriae** Kütz, Bac, 65 1844.

Valves linear, slightly rostrate at the ends. Pseudonodule excentric. Striae 12 in 10 µ. L. of v. 30–40 µ.

Type locality. Europe.

Distribution: Fresh water. Mackinaw Is., Lake Huron (Briggs).

Illustrations· Kütz, Bac, pl. 14, f. 4; Brun, Diat. Alpes, pl. 5, f. 4; Van Heurck, Syn Diat. Belg., pl. 40, f 19, A. Schmidt, Atlas, pl. 305, f. 18–31.

12 **Synedra parvula** Kütz, Bac, 64 1844

Valves lanceolate, with rostrate ends. Pseudonodule broad, excentric. Striae 14–15 in 10 μ. L of v. 15–20 μ.

Type locality Europe.

Distribution Fresh water Local Near Philadelphia.

Illustrations Kütz, Bac, pl 14, f 1, a, b; Van Heurck, Syn Diat Belg., pl. 40, f. 22; Boyer, Diat. Philadelphia, pl. 12, f, 5, 6.

13 **Synedra incisa** Boyer, Bull Torr Club 47: 68 1920

Valves lanceolate, asymmetrical, undulate or incised on one or both margins, with subcapitate ends Pseudoraphe scarcely evident Striae about 18 in 10 μ. L. of v. 20–30 μ This form has the outline of *Synedra affinis* var. *baileyana* H. H Chase (Walker & Chase, Some New and Rare Diatoms, 4 pl 2, f 1 1886) but the striae are not marginal It differs from *Synedra hyperborea flexuosa* Grun, Denks Akad. Wien 48 106, pl 2, f 5, in striation and habitat.

Type locality Nebraska (Coll C J Elmore)

Distribution Fresh water. Known only from the type locality

Illustrations Bull Torr Club, 47 pl 2, f 8

14 **Synedra goulardi** Bréb, Cleve & Grun Sv Vet Akad Handl (2) 17^{1} 107 1880

Valves linear-lanceolate, slightly constricted in the middle, with produced, subacute or subcapitate ends Striae sometimes slightly radiate toward the ends, 10–11 in 10 μ Central space broad, hyaline Pseudoraphe distinct L of v 25–138 μ.

Type locality Buenos Ayres

Distribution. Fresh water Local Philadelphia Florida. Porto Rico.

Illustrations· Cleve & Grun, Sv. Vet.-Akad Handl (2) 17^{1} pl 6, f. 119, A Schmidt, Atlas, pl. 300, f 10–18; Boyer, Diat. Philadelphia, pl 11, f. 12, 13.

15 **Synedra acus** Kütz, Bac., 68. 1844.

Valves lanceolate, acicular, with ends elongate, subcapitate or obtuse. Striae 13–15 in 10 μ. Central space more or less evident. L. of v. to 136 μ

Type locality. Europe

Distribution Fresh water. Generally distributed.

Illustrations Kütz., Bac., pl. 15, f. 7; Van Heurck, Syn. Diat. Belg., pl. 39, f. 4; A. Schmidt, Atlas, pl. 303, f. 7, Boyer, Diat. Philadelphia, pl. 11, f. 9, 18.

16. **Synedra delicatissima** W Smith, Syn Brit. Diat, 1 72 1853

Valves very narrow, lanceolate with slightly capitate ends Striae 15 in 10 μ L. of v 50–100 μ.

Type locality Ireland

Distribution Fresh water Generally distributed

Illustrations W Smith, Syn Brit Diat, 1 pl 12, f 94, Van Heurck, Syn Diat Belg, pl 39, f 7, H L Smith, T S. 551

Synedra delicatissima angustissima Grun, Van Heurck, Syn. Diat. Belg, pl 39, f 10. A longer form than the type

17 **Synedra spathulifera** Grun, Van Heurck, Syn. Diat Belg pl 38 1881

Valves linear, slightly inflated at the rounded ends L of v. 100–150 μ.

Type locality Belgium.

Distribution Fresh water Rather rare Lake Michigan

Illustrations Van Heurck, Syn. Diat. Belg, pl. 38, f. 4

18 **Synedra chaseana** B W Thomas, in Walker & Chase Some New and Rare Diatoms, 4, 1886

Valves slender, much elongated, with ends constricted and rounded Striae 10 in 10 μ. Pseudoraphe distinct L of v. 50–800 μ

Type locality Lake Michigan.

Distribution Fresh water Chicago Plankton, Lake Erie (Coll L H Tiffany)

Illustrations Walker & Chase, Some New and Rare Diatoms, pl 2, f 3, in H L Smith, T S 588

19. **Synedra oxyrhynchus** Kütz, Bac 66 1844

Valves linear, with long, subrostrate ends Very near the type form of *S ulna*

Type locality Europe.

Distribution Fresh water Common.

Illustrations Kütz., Bac, pl 14, f 8, Van Heurck, Syn. Diat. Belg., pl 39, f. 1, a

20. **Synedra radians** Kütz. Bac., 64. 1844.

Valves linear-lanceolate, narrow, with obtuse, produced ends, slightly capitate. Central space usually absent. Striae 14–17 in 10 μ. Originally named because the frustules, at first adnate and tabulate, separate at one end and become radiate, but this frequently happens in other species.

The synonymy is much confused. *S. tenera* W. Smith, sometimes given as synonymous, has finer striae.

Type locality: Europe.

Distribution Fresh water Local. Philadelphia

Illustrations Kütz, Bac, pl 14, f 7, Van Heurck, Syn Diat. Belg, pl 39, f 11; Brun, Diat Alpes, pl 5, f 6, H L Smith, T S 574, Boyer, Diat Philadelphia, pl 12, f 8

21 **Synedra familiaris** Kütz Bac 68 1844

Frustules tabellate, slightly attenuate in zone view at the truncate ends. Valves narrow, linear-lanceolate, with subacute or subcapitate ends Striae subtle, 17–19 in 10 μ L of v 40–80 μ Central space hyaline

Apparently not distinct from *S radians*, according to De-Toni, and considered by Van Heurck as possibly a variety of *S rumpens* Kütz

Type locality Europe

Distribution Fresh water Generally distributed

Illustrations. Kütz, Bac., pl. 15, f. 12, Van Heurck, Syn. Diat Belg., pl 40, f. 15, 16; H L Smith, T S 553

22 **Synedra longiceps** Ehrenb Ber Akad Berlin, 1845 in Kütz Sp Alg 45 1849

Valves linear, inflated at the ends which are styliform, produced Pseudoraphe indistinct Striae 13–14 in 10 μ, punctate Central space frequently hyaline L of v. to 190 μ Frustules often flexed and, in valve view, sinuous or irregular In its irregular outline this form appears to be similar to the supposed sporangial frustules of *S ulna* but the striae are finer In a gathering from Panama (Coll B F Johnson), a form exactly like *S longiceps* in outline occurs with striae 9–10 in 10 μ, while in the same material valves slightly constricted in the middle, others with but slight inflations at the ends and some irregular as in the case of the valves from the Great Lakes, are noticed Normal valves of *S ulna* are common in the deposit

Type locality Lake Michigan

Distribution Fresh water Mackinaw, Lake Superior

Illustrations H L Smith, T. S. 563

23 **Synedra capitata** Ehrenb, Pogg Annal Phys., pl 3 f 3 1836

Valves linear, inflated at the triangular, capitate, conical, subacute ends. Pseudoraphe narrow. Striae 9 in 10 μ, punctate, radiating at the ends L. of v to 500 μ. Central space sometimes hyaline. Differs from *S. longiceps* in its more robust character and in the coarseness of the striae which radiate at the ends

Type locality Europe.

Distribution: Fresh water. Local. St. Paul, Minn. Tully Lake, N. Y. Philadelphia. Lake Michigan Fossil in the Miocene and peat deposits

Illustrations Ehrenb., Mikrogeol., pl. 33, I, f. 22; II, f. 14; f. 16; Kütz., Bac., pl. 14, f 19; W. Smith, Syn Brit Diat., I pl 12, f 93; Pritchard, Infusoria, pl. 4, f. 29, Brun, Diat. Alpes, pl. 5, f 8; Meister, Kiesalg. Schweiz, pl. 7, f 6, A Schmidt, Atlas, pl 300, f 1–9, Boyer, Diat Philadelphia, pl. 11, f 8

24 **Synedra laevigata** Grun, Trans. Micr Soc Lond 18 166 1877

Frustules linear, slightly attenuated at the ends Valves linear-lanceolate, subacute. Striae very subtle, more than 38 in 10 µ L of v. 80–240 µ (Grun.)

Type locality Honduras

Distribution Marine Known from the type locality only.

Illustrations Grun, Trans Micr Soc Lond, 18 pl 193, f 3.

25. **Synedra capillaris** Grun, Trans. Micr Soc. Lond 18 168 1877

Valves linear, very narrow, slightly incrassate in the middle Pseudoraphe narrow, distinct Striae transverse, subtle, 19 in 10 µ. L of v 225 µ (Grun)

Type locality Honduras.

Distribution. Marine Known from the type locality only.

Illustrations Grun, Trans Micr Soc Lond., 18 pl 194, f 2.

26 **Synedra gaillonii** (Bory) Ehrenb. Inf, pl 17 1838

Navicula gaillonii Bory, Encyl Dict Hist, pl 24 1824?

Valves narrow, linear-lanceolate, slightly tapering to the obtuse ends. Striae about 10 in 10 µ, punctate Pseudoraphe distinct. L. of v to 220 µ

Type locality Europe

Distribution Marine Atlantic and Pacific Coasts

Illustrations: Ehrenb., Inf, pl 17, f. 2, Kütz., Bac., pl. 30, f. 42; W Smith, Syn. Brit. Diat., I pl. 30, f 265; Pritchard, Infusoria, pl. 12, f. 34; Van Heurck, Syn. Diat Belg, pl 39, f. 18; H. L. Smith, T S 557

Synedra gaillonii minor Kütz, Bac., 68 1844. Striae 14 in 10 µ. L of v. 50–70 µ. Van Heurck, Syn. Diat Belg., pl. 40, f. 2. Bahama Islands.

27 **Synedra investiens** W Smith, Syn Brit. Diat, 2: 98. 1856.

Valves narrow, linear-lanceolate, attenuated toward the rounded ends, sometimes slightly gomphonemoid. Pseudoraphe distinct. Striae coarse, 9–12 in 10 µ, punctate. L. of v. 15–40 µ.

Type locality England

Distribution: Marine. Newfoundland.

Illustrations. Grun., Novara-Exp. Bot. I pl. I: f. 2; Van Heurck, Syn Diat. Belg., pl. 40, f. 3; A. Schmidt, Atlas, pl. 306, f. 19–24.

28 **Synedra hyperborea** Grun Denks. Akad Wien 48 106 1884.

Valves linear-lanceolate, with ends more or less produced. Pseudoraphe distinct Striae 25–27 in 10 μ L of v 25–32 μ

Type locality: Franz Josef Land.

Distribution · Davis Strait Common

Illustrations · Grun, Denks Akad Wien 48 pl 2, f 4

Synedra hyperborea rostellata Grun. Denks Akad Wien 48 106 pl 2, f 6 Valves with more slender, produced ends and longer. With the type

29 **Synedra affinis** Kütz. Bac 68 1844

Valves lanceolate, narrow, tapering to the obtuse, sometimes slightly capitate ends. Striae marginal, 12–15 in 10 μ Pseudoraphe a broad, lanceolate space L. of v. to 120 μ. Two long, curved auxospores are formed from one mother cell (Karsten, Diat. Kieler Bucht, in Wissenschaftliche Meeresuntersuchungen, 4 24. 1889)

Type locality. Europe

Distribution Marine, brackish, and fresh (?) water Atlantic Coast. Very common

Illustrations. Kütz, Bac pl. 15, f 6, 11, Janisch & Rab, in Rab, Beitr Alg. 1 · pl. 4, f. 6, W Smith, Syn Brit Diat 1 pl 12, f. 97, Van Heurck, Syn Diat Belg. pl. 41, f 13, Boyer, Diat. Philadelphia, pl 12, f. 3; A. Schmidt, Atlas, pl. 304, f 6–12; H. L. Smith, T S. 542.

Synedra affinis delicatula Grun., in Cleve & Grun, Sv Vet.-Akad. Handl. II. 17^2 105 pl 6, f. 115. 1880 Van Heurck, Syn. Diat. Belg, pl 41, f. 16. Valves slender Striae 12–13 in 10 μ. Whidby Is, Puget Sound

Synedra affinis fasciculata (Kütz) Van Heurck, Syn. Diat Belg., 153. pl 41, f 15. 1881. *Synedra fasciculata* Kütz., Bac., 68. pl 15, f 5. Valves elliptical-lanceolate. Striae 12–13 in 10 μ. L of v. 30–70 μ. Pacific Coast.

Synedra affinis gracilis Grun, in Van Heurck, Syn Diat. Belg., pl. 41, f. 15 B. 1881. Valves slender. Striae 12–14 in 10 μ. Whidby Is., Puget Sound.

Synedra affinis tenuis Grun., in Van Heurck, Syn Diat Belg., pl 41, f. 17 1881. Valves slender, tapering to the ends Striae 14 in 10 μ. Whidby Is., Puget Sound

The above varieties have intermediate forms.

30. **Synedra parva** Kütz., Sp. Alg., 46. 1849

Valves lanceolate, with slightly rostrate-capitate ends. Striae marginal, 20 in 10 μ. L of v 25–70 μ.

Type locality Europe

Distribution Marine. Jamaica

Illustrations Van Heurck, Syn. Diat. Belg, pl. 41, f. 23, H L. Smith, T S 571

31 **Synedra tabulata** (Ag.) Kütz. Bac., 68 1844.

Diatoma tabulatum Ag, Consp Crit Diat, 50 1832

Valves lanceolate, with obtuse ends Striae marginal, very short, 9–11 in 10 µ L of v to 180 µ Frustules usually occur in broad tablets.

Type locality Denmark

Distribution Marine Long Island Sound, N Y.

Illustrations· Kütz, Bac, pl 15, f. 10; W Smith, Syn. Brit. Diat I pl. 12, f. 96, Van Heurck, Syn Diat. Belg, pl 41, f 9 a, Boyer Diat Philadelphia, pl 12, f 4 a (as var of *S affinis*)

32 **Synedra laevis** Ehrenb Abh Akad Berlin, 137 1843

Valves slender, linear-lanceolate, gradually attenuate to the subcapitate, obtuse ends Pseudoraphe indistinct Striae subtle, about 25 (?) in 10µ L of v 75–190 µ

Type locality North Sea

Distribution Marine. Atlantic and Pacific Coasts Cuba. Yucatan

Illustrations Ehrenb, Abh Akad Berlin, 1843 pl 2, 6, f 3, Kütz, Bac, pl 15, f 8, H. L Smith, T S 562.

33 **Synedra provincialis** Grun. Mo Micr Jour 18 166 1877

Valves linear-lanceolate, inflated at the rounded ends Pseudoraphe narrow. Striae 30 in 10 µ Terminal nodules distinct. L of v 65–110 µ

Type locality Mediterranean Sea.

Distribution Marine St. Thomas (Oestrup)

Illustrations Grun, Mo Micr. Jour. 18 pl. 193, f. 6, Van Heurck, Syn Diat Belg pl 40, f 8.

34. **Synedra barbatula** Kütz., Bac. 68 1844

Valves elliptical-lanceolate, slightly rostrate at the ends. Pseudoraphe narrow. Striae 18 in 10 µ. L. of v. 20–25 µ.

Type locality North Sea.

Distribution Marine. St. Croix (Oestrup).

Illustrations. Kütz., Bac, pl. 15, f 10, 4; Van Heurck, Syn Diat. Belg, pl 40, f 6

35 **Synedra demerarae** Grun., Van Heurck, Syn. Diat. Belg., pl. 41 1881

Valves narrow, lanceolate, gradually attenuated to the capitate ends. Striae marginal, 8 in 10 µ, not always opposite each other, L. of v. 37 µ.

Type locality Demerara.

Distribution. Fresh water Chicago water supply.

Illustrations Van Heurck, Syn Diat. Belg, pl 41, f 26.

36 **Synedra kamtschatica** Grun Verh Zool-Bot. Ges. Wien 12 404. 1862

Valves linear-lanceolate, slightly attenuated to the rounded or subcapitate ends Striae 14 in 10 µ, marginal, absent in the middle of the valve L of v to 200 µ

Type locality Kamtschatka.

Distribution· Marine Arctic Sea. Greenland Davis Strait.

Illustrations· Grun, Verh Zool-Bot Ges Wien, 12. pl 5, f 6, H. L. Smith T S 561

37 **Synedra cuneata** Grun. Hedwigia, 6 5 1867

Sceptroneis cuneata Grun, Mo Micr Jour 18 169 1877

Valves elongate, clavate, cuneate at the apex, obtuse Pseudoraphe none or indistinct Longitudinal furrows near the margin indistinct or, sometimes, obsolete. Striae 16 in 10 µ, subtly punctate, radiate at the apex in arcuate lines L of v to 320 µ

This form appears to be the same as *Synedra gomphonema* Janisch & Rab, in Rab, Beitr Alg 1 13 pl 2, f 6, but the figure shows a broad pseudoraphe which is not found in any specimens from Honduras examined. It may belong to the genus *Pseudosynedra* It is not the same as *Sceptroneis coluber* Brun

Type locality Honduras

Distribution Marine Coast of Florida

Illustrations Mo Micr Jour. 18· pl 194, f 3; A Schmidt, Atlas, pl 305, f 32–34

38 **Synedra thalassiothrix** Cleve Bih Sv Vet.-Akad Handl 1^{11} 22 1873

Thalassiothrix longissima Cleve & Grun, Sv Vet-Akad Handl II 17^2: 108 1880

Valves linear, much elongated, slightly wider in the middle, with rounded ends Striae about 12 in 10 µ, punctate L. of v 300–1350 µ (the longest known diatom) Chromatophores numerous, rounded discs

Type locality North Atlantic Ocean

Distribution Pelagic. Arctic Sea. Davis Strait Bay of Fundy

Illustrations Cleve, Bih. Sv. Vet.-Akad Handl 1 pl 4, f 24; H. L. Smith, T S 584.

The frustules are not radiately joined as in *Thalassiothrix* but occur in bundles or are solitary.

39. **Synedra nitzschioides** Grun, Verh. Zool.-Bot. Ges. Wien, 12 403 1862

Thalassiothrix nitzschioides Grun., Van Heurck, Syn Diat. Belg., pl. 43. 1881

Valves linear-lanceolate, with rounded ends. Puncta marginal, 10–12 in 10 µ. L. of v. 20–75 µ. Resembles *S. affinis* in outline. Frustules in radiate clusters as in *Thalassiothrix*. Grunow suggests it be placed under a new genus *Thalassionema*

Type locality. North Pacific Ocean.

Distribution Marine Pacific Coast.

Illustrations· Grun., Verh. Zool -Bot Ges. Wien, 12 pl 5, f. 18; Novara-Exp Bot. 1 pl 1, A, f. 7; Van Heurck, Syn Diat Belg., pl. 43, f 7–10, H. L Smith, T S 568.

2 ARDISSONIA

Longitudinal lines two.	
Linear-lanceolate, inflated in the middle and at the ends.	41 *S. fulgens*
Linear, sigmoid.	47. *S. anguinea*
Longitudinal lines three.	
Valves broadly linear, contracted near the ends	42 *S superba*
Longitudinal lines four.	
Linear, broad, subcapitate	44. *S pulcherrima*
Linear, attenuated to the rounded ends.	45 *S. formosa*
Longitudinal lines four to six.	
Broad, rounded at the ends	43 *S. robusta*
Longitudinal lines inconspicuous.	
Sub-linear, widened in the middle.	46 *S baculus*
Longitudinal lines obsolete.	
Linear-lanceolate, slightly widened in the middle.	40 *S crystallina*

40. **Synedra crystallina** (Ag) Kütz, Bac, 69 1844
Diatoma crystallinum Ag, Syst Alg, 3 1824

Valves elongate, linear-lanceolate, slightly widened at the rounded or sub-truncate ends Pseudoraphe distinct. Longitudinal lines obsolete Striae 9–11 in 10 µ, punctate, slightly radiating near the ends, obsolete at the ends. L of v. to 800 µ.

Type locality. Kattegat

Distribution Marine. Honduras.

Illustrations Kütz., Bac. pl. 16, f 1, W. Smith, Syn Brit. Diat., 1 pl. 12, f 101.

Synedra crystallina bacillaris Grun., and *Synedra crystallina insignis* Grun, Mo. Micr. Jour. 18 167, 1877, pl. 193, f. 10, 12, are here united to the type

41 **Synedra fulgens** (Grev) W Smith, Syn. Brit. Diat., 1: 74 1853
Exilaria fulgens Grev, Scot. Crypt. Fl, pl. 291 1827.
Ardissonia fulgens (Grev.) Grun, Cleve & Grun., Sv. Vet -Akad Handl. II. 17^{2}· 108. 1880.

Valves elongate, linear-lanceolate, inflated in the middle and at the rounded ends. Striae 15 in 10 μ, punctate, traversed by an indistinct pseudoraphe and two marginal lines L. of v to 375 μ

Type locality Scotland

Distribution Marine Atlantic Coast

Illustrations. W. Smith, Syn Brit Diat, 1 pl 12, f 103, Van Heurck, Syn Diat Belg, pl 43, f 1, 2, H L Smith, T S 556

42 **Synedra superba** Kütz Bac, 60 1844

Ardissonia superba (Kütz) Grun, Cleve & Grun, Sv Vet Akad Handl II 17^2 108 1880.

Valves broadly linear, slightly contracted toward the rounded ends Striae 10–11 in 10 μ, punctate, traversed by three equidistant, longitudinal lines L. of v 160–550 μ The middle line is somewhat indistinct

Type locality Adriatic Sea

Distribution Marine Atlantic Coast Honduras Colon

Illustrations Kütz, Bac, pl. 15, f 13, Janisch & Rab, in Rab, Beitr Alg 1 pl 3, f 2, W Smith, Syn Brit Diat, 1 pl 12, f 102, H L Smith, T S 578

The var *minor* Grun, is here included with the type

43 **Synedra robusta** Ralfs Pritchard Infusoria 789 1861

Ardissonia robusta (Ralfs) De Notaris Nuovo Giorn ,Bot Ital 95 1871

Valves linear-elliptical, elongate, broad, rounded at the ends Striae 8 in 10 μ, traversed by a distinct pseudoraphe and by two intramarginal and two or four marginal lines L of v to 450 μ.

Type locality Corsica.

Distribution Marine Pacific Ocean

Illustrations Pritchard, Infusoria, pl 8, f 3, Van Heurck, Syn Diat Belg, pl 42, f. 6, 7, H L Smith, T S 575

44 **Synedra pulcherrima** Hantzsch in Rab Beitr Alg 1 19 1863

Ardissonia pulcherrima (Hantzsch) Grun, Cleve & Grun, Sv Vet-Akad Handl II 17^2 108 1880

Valves linear, broad, dilated at the subcapitate, rounded or subconical ends. Striae punctate, radiate at the ends, traversed by two longitudinal lines on each side of the pseudoraphe L of v to 360 μ

Type locality Honduras

Distribution Marine. West Indies

Illustrations Hantzsch, in Rab, Beitr Alg 1 pl 5, f 2.

45 **Synedra formosa** Hantzsch, in Rab, Beitr Alg. 1 19 1863

Ardissonia formosa (Hantzsch) Grun, Cleve & Grun, Sv Vet-Akad Handl II 17^2 108 1880

Valves linear, gradually attenuate to the rounded ends Striae 9 in 10 μ, punctate, traversed by two longitudinal lines on each side of the pseudoraphe L of v. to 310 μ.

Type locality Honduras

Distribution Marine Vera Cruz.

Illustrations Hantzsch, in Rab, Beitr Alg 1 pl 5, f 3, Van Heurck, Syn Diat Belg., pl 42, f 8

46 **Synedra baculus** Greg Trans. Micr Soc Lond 5 83 1857
Synedra baculus var *minor* Grun, Trans Roy Micr Soc, 18 168 1877

Valves sublinear, slightly widened in the middle and at the ends Pseudoraphe scarcely evident Striae subtly punctate, 11–12 in 10 µ, radiating at the ends Longitudinal lines marginal, inconspicuous L of v. to 500 µ

Type locality Scotland

Distribution. Marine Honduras

Illustrations Greg., Trans Micr Soc. Lond, 5 pl. 1, f 54, Grun., Mo Micr Jour. 18 pl 194, f 1

47 **Synedra anguinea** Boyer, Bull Torr Club 47 68. 1920

Frustule in zone view sigmoid at the ends Valves linear, sigmoid at the slightly tapering, rounded ends Pseudoraphe very narrow, somewhat indefinite. Striae 9–10 in 10 µ, punctate, interrupted by two marginal lines Ends of valve with radiating lines of puncta L of v 315 µ

Type locality Colon

Distribution Marine Known only from the type locality

Illustrations Bull. Torr. Club, 47 pl 2, f 1

3 TOXARIUM

Valves tumid in the middle, subcapitate, with undulating sides	48 *S undulata*
Valves tumid in the middle, subcapitate, not undulating.	49 *S hennedyana*
Valves arcuate, tumid in the middle	50. *S. rostrata*

48 **Synedra undulata** Bailey, Smith, Contr, 7 15 1853
Toxarium undulatum Bailey, Smith Contr, 7 15 1853
Synedra undulans Greg, Trans Micr Soc Lond, 3 41 1855
Synedra undulata Greg., Trans Roy Soc Edinb, 21 531 1857
Synedra undosa Grun, Mo Micr Jour, 18 167 1877

Valves elongate, slender, lanceolate, tumid in the middle, subcapitate at the ends, with undulating sides. Pseudoraphe and pseudonodules distinct Striae punctate, 10–19 in 10 µ, somewhat irregular at the centre L of v. to 450 µ

Type locality Narragansett Bay.

Distribution· Marine. Atlantic Coast

Illustrations: Bailey, Smith. Contr., 1853, 7. pl., f 24, 25; Greg., Trans. Micr. Soc. Lond., 3 pl 4, f 23; Trans Roy Soc. Edinb., 21:

pl. 14, f. 107; Janisch & Rab., in Rab. Beitr Alg., 1 pl. 3, f 1, Van Heurck, Syn Diat. Belg., pl. 42, f. 2; Grun., Mo. Micr Jour., 1877, pl. 193, f 8; A. Schmidt, Atlas, pl. 305, f. 4–6

Bailey, in "Notes on New Species and Localities," Smith Contr, 7 15 1853, named this form which he discovered, *Synedra undulata*, but, later, changed the name to *Toxarium undulatum* Gregory, without the knowledge of Bailey's form, found it in the Glenshira sand and named it *Synedra undulans*, later, in the "Diatomaceae of the Clyde," naming it *Synedra undulata* The name must, therefore be referred to Bailey I can see no difference between Bailey's form and Grunow's *Synedra undosa* in which the striae are said to be 19 in 10 μ The striae are quite variable A variety occurs in San Pedro Bay, Calif, in which the middle of the valve is inflated on one side only. L. of v. 350 μ. Striae about 13 in 10 μ.

49. **Synedra hennedyana** Greg, Trans. Roy Soc Edinb, 21 532 1857

Valves elongate, slender, tumid in the middle and subcapitate at the ends, with sides not undulating. Pseudoraphe indistinct Striae 12–14 in 10 μ, irregular in the middle L of v. to more than 1000 μ. Resembles *S undulata* except in the absence of undulations

Type locality · Scotland

Distribution: Marine. Atlantic Coast, in the stomach of fish from the coast of South Carolina Abundant at Hawks Park, Fla (Coll F J. Keeley)

Illustrations Greg., Trans. Roy Soc. Edinb 21 pl 14, f. 108; Van Heurck, Syn Diat. Belg, pl 42, f. 3, A Schmidt, Atlas, pl. 305, f. 1–3.

50 **Synedra rostrata** (Hantzsch) A. Schmidt Atlas, pl 305

Toxarium rostratum Hantzsch, in Rab Beitr Alg 1 19 1863

Valves elongate, arcuate, tumid in the middle and at the ends, not undulate. Puncta not in rows, scattered in the middle L. of v. to 530 μ

Type locality. West Indies.

Distribution: Marine. Known from the type locality only.

Illustrations · Hantzsch, in Rab, Beitr Alg, 1 pl. 5, f. 4; A. Schmidt, Atlas, pl. 305, f. 7–9

Near *S. hennedyana* from which it is distinguished chiefly by its arcuate form.

Species Indeterminate

Synedra punctata Ostr Dansk, Bot. Ark. 1': 20. 1913.

Valves linear, with rounded ends. Longitudinal lines two, submarginal. Striae 16 in 10 µ. Central part of valve between the longitudinal lines with irregular or scattered puncta L. of v. ?. A fragment only observed.

Type locality St. Croix (Oestr)

Distribution Marine Known only from the type locality.

Illustrations Dansk Bot Ark 1′ pl 1, f 21

64 **PSEUDOSYNEDRA** Leud Ann Jard Bot Buitenz 11 31 1892

Valves oar-shaped or lanceolate and constricted at each end. Pseudoraphe absent or very narrow Striae transverse.

Type species, *Pseudosynedra peragalli* Leud

1 **Pseudosynedra peragalli** Leud, Ann. Jard Buitenz 11 31 1892

Valves oar-shaped, slightly expanded at the lower end Striae transverse, punctate, 12 in 10 µ The ends of the valves, under low powers, appear hyaline but are finely punctate in radiating lines Pseudoraphe not evident L. of v about 400 µ.

Type locality· Java.

Distribution Marine. Coast of S. Carolina (In stomach of fish).

Illustrations Leud, Ann Jard Buitenz, 11 pl 5, f 2; Van Heurck, Treat. Diat, 320, f 76.

65 **CAMPYLOSTYLUS** Shadb (Ms.) 1849 Grev Quart Jour Micr Sci 10 232 1862

Valves arcuate, clavate, inflated at one or both apices or attenuate at one apex Pseudoraphe narrow Striae transverse.

Type species, *Campylostylus striatus* Shadb.

1 **Campylostylus striatus** Shadb (Ms) 1849 Grev Quart Jour Micr Sci, 10 232 1862

Synedra normanniana Grev, Quart Jour Micr. Sci, 10 231 1862

Valves linear-clavate, or more inflated near one end than the other, arcuate, sometimes twisted, attenuate at one end or inflated at both rounded apices. Pseudoraphe narrow, sometimes indistinct or excentric Striae 13–15 in 10 µ. L of v to 450 µ.

Type locality Honduras (Mahogany logs in London docks).

Distribution Marine Common in a gathering obtained from the stomachs of fish from the coast of S. Carolina

Illustrations: Grev., Quart Jour Micr. Sci., 10: pl. 10, f. 1–3; Van Heurck, Treat. Diat, 318, f. 74

66 **ASTERIONELLA** Hassall, Micr Exam Water, 10 1850

Frustules linear, slightly inflated at the ends, arranged in star-shaped clusters which soon break up. Valves linear, unequally inflated at the ends.

Type species, *Asterionella formosa* Hassall.

Valves linear, unequally inflated at the ends A hyaline area at each end	1	*A formosa*
Valves attenuate at one end, capitate at the other.	2	*A. ralfsii*
Valves unequally inflated at the ends, slightly tumid in the middle.	3.	*A. bleakleyi*
Valves unequally capitate at each end, tumid in the middle	4.	*A inflata*
Valves slightly tumid in the middle and at the upper end, constricted near the base and crossed by a transverse costa	5	*A notata*

1 **Asterionella formosa Hass., W Smith, Syn Brit Diat. 2 81 1856**

Valves linear, unequally inflated at the ends. Striae subtle, about 17 in 10 µ, crossed by a narrow or indistinct pseudoraphe. An ovate, hyaline area at each end L. of v. to 100 µ

Type locality England

Distribution Fresh water Local Newark, N J Media, Penna. (T. C Palmer) Lake Michigan. Cooper's Creek, N J. Lake Erie.

Illustrations T. West, Trans Micr Soc Lond, 8 pl 7, f 8 1860, Heiberg, Consp. Diat, pl 6, f. 20, Van Heurck, Syn Diat Belg, pl 51, f 19, 20, Boyer, Diat Philadelphia, pl 12, f. 19–21.

2 **Asterionella ralfsii W Smith Syn Brit Diat 2 81 1856**

Frustules slightly wider at one end than the other Valves attenuate at one end, rounded, capitate at the other Striae subtle L of v. 30 µ

Type locality England.

Distribution Fresh water. Saco pond, N. H New Jersey

Illustrations Ralfs, Pritchard, Infusoria, pl. 4, f 18, Van Heurck, Syn. Diat Belg., pl 52, f 2, H L Smith, T. S 47

3 **Asterionella bleakleyi W Smith Syn Brit Diat 2 82 1856**

Valves unequally inflated at the ends, slightly tumid in the middle. Striae subtle. L of v to 55 µ.

Type locality: England

Distribution: Marine or brackish water St Mary's River, Ga. Savannah rice fields Coast of Barbadoes.

Illustrations: T. West, Trans Micr. Soc Lond, 8. pl. 7, f. 10. 1860; Lewis, Proc Acad. Phila., pl. 2, f. 9. 1861; Van Heurck, Syn. Diat. Belg pl. 52, f. 1.

4. **Asterionella inflata Heiberg. Consp. Diat 69. 1863**

Valves linear, unequally capitate at each end and tumid in the middle Pseudoraphe indistinct. Striae 20–25 in 10 µ, punctate. L. of v. 30 µ.

Apparently the same as *A bleakleyi* from which it differs in habitat

Type locality: Denmark.

Distribution: Fresh water. Mays Landing, N. J.

Illustrations. Heiberg, Consp. Diat., pl. 6, f. 21, Boyer, Diat. Philadelphia, pl. 12, f 22

5. **Asterionella notata** Grun., Van Heurck, Syn Diat Belg pl. 52 1881

Asterionella bleakleyi notata Grun., Mo. Micr Jour. 18 166 1877

Valves slightly tumid in the middle and at the upper extremity, constricted near the spathulate, dilated base which is crossed by a transverse costa. Striae about 30 (40?) in 10 µ. Frustules linear, slightly widened at the base which is marked on each side by the edge of the transverse costa L. of v. to 105 µ.

Type locality Honduras

Distribution Marine. Coast of Barbados Common.

Illustrations: Van Heurck, Syn. Diat. Belg, pl 52, f. 3; Grun., Mo. Micr. Jour., 18 pl 193, f 2

67 **THALASSIOTHRIX** Cleve & Grun., Sv Vet.-Akad. Handl. II 17^1 108. 1880. em. Castr, Rep. Voy Chall Bot. 2 53 1886.

Frustules linear, radiately united by a gelatinous cushion, and, after reduplication, united by a triangular isthmus (Castr.). Chromatophores numerous, rounded or elliptical discs, each containing a pyrenoid.

Type species, *Asterionella frauenfeldii* Grun.

1 **Thalassiothrix frauenfeldii** (Grun.), Castr Rep Voy Chall Bot 2: 54. 1886.

Asterionella frauenfeldii Grun, Verh Zool-Bot Ges Wien, 13 140 1863.

Frustules in zone view linear, narrow. Valves linear, arcuate, rounded at one end and attenuate at the other, with a single row of elevated puncta on each border, 7–9 in 10 µ L. of v. 50–150 µ.

Type locality: Island of Nicobar

Distribution Pelagic. Arctic Sea.

Illustrations Grun., Verh Zool.-Bot. Ges. Wien, 13: pl. 14, f. 18; Castr Rep Voy. Chall. Bot, 2: pl. 14, f. 7, 8, Van Heurck, Syn. Diat. Belg., pl. 37, f 11, 12

Thalassiothrix frauenfeldii arctica Grun., Van Heurck, Syn. Diat. Belg., pl 37, f. 14. Puncta 7 in 10 µ. Arctic Sea.

Thalassiothrix frauenfeldii tenella Grun, Van Heurck, Syn. Diat. Belg., pl. 37, f. 15 Arctic Sea.

Species Excluded

Thalassiothrix longissima Cleve & Grun., is *Synedra thalassiothrix* Cleve.

Thalassiothrix nitzschioides Grun., is *Synedra nitzschioides* Grun.

68. CLAVICULA Pant., Beitr Foss. Bac Ungarns 1: 37 1886.

Valves elongate, linear, inflated at the ends. Surface irregularly punctate, with two longitudinal, smooth areas

Type species, *Clavicula polymorpha* Pant.

Consists of fossil species with the exception of the following·

1 **Clavicula recens Mereschk Scripta Botanica, Universitatis Petropolitanae, Fasc. 18 26. 1902**

Valves narrow, abruptly attenuated toward the inflated apices, broader toward the centre. Puncta 6–7 in 10 µ, irregularly scattered along the median line and at the apices and regularly along the margin. L. of v. 209–279 µ. (Mereschk.)

Type locality. Coast of California

Distribution Marine. British Columbia (Mereschk)

Illustrations Scripta Botanica, Fasc. 18 pl. 5, f 15

(c). EUNOTIINAE

1. *Eunotia*. Frustules either free, in fasciae or epiphytic. Valves arcuate, usually with a terminal nodule. A partial pseudoraphe sometimes present near the concave margin

2. *Amphicampa*. Frustules usually solitary Valves dentate on both margins

3. *Ceratoneis*. Valves arcuate, with a partial excentric pseudonodule in the middle of the concave side

4. *Actinella*. Valves arcuate, inflated at one end

69 EUNOTIA Ehrenb., Abh. Akad Berlin, 1837 15 1837

Frustules rectangular, either united in fasciae, free or epiphytic. Valves arcuate, transversely striated, with distinct terminal nodules. Pseudoraphe usually absent or very narrow and indistinct. Chromatophores laminate, one on each valve extending over the ventral connective zone.

Type species, *Eunotia arcus* Ehrenb

Divided into two sections:

Himantidium. Frustules in fasciae

Eunotia proper. Frustules free or binately united.

HIMANTIDIUM

Valves arcuate, linear Apices subcapitate, recurved.	1. *E major*
Valves arcuate or sometimes straight on the ventral side, capitate at the ends.	2. *E arcus*
Valves arcuate, narrow, with parallel sides and slightly capitate, recurved ends.	3. *E gracilis*
Valves slightly arcuate, with parallel sides. Apices constricted, subcapitate and recurved.	4. *E. exigua*

Valves arcuate, with parallel sides and inflated ends.	5. *E. tauntoniensis*
Valves arcuate, with parallel sides and apices recurved into dorsal elevations.	6. *E. nymanniana*
Valves linear, slightly arcuate, subrostrate	7. *E. pectinalis*
Valves convex on the dorsal, straight on the ventral side, incised near the ends	8. *E. veneris*

The genus is well defined by reason of its arcuate valves. Its infinite variation in form, size, and striation, has led to a great number of specific names, many of which, if determined by figures in "Mikrogeologie" and in Kützing, are difficult, if not impossible, to identify In the following descriptions what appear to be the essential forms are included, although it would be possible to extend the list The species must have been abundant in the period immediately following the glacial, comprising a large amount of the peat deposits of New England and Canada, and are still found living, chiefly in the glacial lakes and ponds

1 **Eunotia major** (W Smith) Rab Fl Eur 1 72 1864

Himantidium majus W Smith, Syn Brit Diat, 2 14. 1856

Valves linear, arcuate, with the apices subcapitate and recurved Striae punctate, 8–12 in 10 μ Connective zone with puncta 14–16 in 10 μ L of v to 190 μ

Type locality England

Distribution Fresh water Generally distributed northward.

Illustrations W Smith, Syn. Brit. Diat, 2 pl. 33, f 286, Van Heurck, Syn Diat Belg, pl 34, f 14; A Schmidt, Atlas, pl 273, f. 35–41, Boyer, Diat Philadelphia, pl. 13, f 1, 2.

2 **Eunotia arcus** Ehrenb Inf 191 1838

Valves arcuate, the ventral side sometimes straight, capitate at the ends. Striae lineate, 10–12 in 10 μ on the valves, 22 in 10 μ on the zone L of v. 30–90 μ.

Type locality North America.

Distribution. Fresh water. Common, especially in ponds in New England.

Illustrations Ehrenb., Inf, pl. 21, f. 22; Mikrogeol., pl. 16, 1, f, 24, etc ; W. Smith, Syn. Brit. Diat., 2 pl. 33, f. 283; Van Heurck, Syn Diat. Belg., pl. 34, f. 2; Brun, Diat. Alpes, pl. 2, f. 20; A. Schmidt, Atlas, pl. 274, f. 32–54.

Eunotia arcus bidens Grun., Van Heurck, Syn. Diat. Belg., pl. 34, f. 7. Dorsal side bigibbous. With the type.

Eunotia arcus minor Grun., Van Heurck, Syn. Diat. Belg , pl. 34, f. 3. Valves smaller and more slender. With the type

3. **Eunotia gracilis** (Ehrenb) Rab. Fl Eur 1 72 1864

Himantidium gracilis Ehrenb , Abh Akad Berlin, 129 1843

Not *E. gracilis* W Smith, Syn Brit Diat 1 16. pl 30, f. 249 1853.

Valves arcuate, narrow, with parallel sides and slightly capitate, recurved apices. Striae 10–12 in 10 µ, lineate Connective zone with striae about 20 in 10 µ. L. of v to 160 µ Forms occur intermediate between *E. major* and *E. gracilis*

Type locality Europe

Distribution Fresh water. Common, especially northward.

Illustrations Ehrenb., Abh. Akad. Berlin, pl. 2, 1, f 9, W. Smith, Syn Brit. Diat., 2 pl. 33, f. 285; A Schmidt, Atlas, pl. 271, f. 7, Boyer, Diat Philadelphia, pl. 13, f 3 (?), H L Smith, T. S 192

4 **Eunotia exigua** (Bréb) Rab Fl Eur 1: 73 1864

Himantidium exiguum Bréb , in Kütz , Sp Alg , 8 1849

Valves slightly arcuate, with parallel sides Apices constricted, capitate, recurved Striae subtle, about 24 in 10 µ L of v. 10–18 µ

Type locality France

Distribution Local Ridley Creek, near Philadelphia.

Illustrations Grun , Verh. Zool -Bot Ges. Wien 12 pl. 3, f. 15; Van Heurck, Syn Diat Belg., pl 34, f 11 (upper fig).

5 **Eunotia tauntoniensis** Hustedt A Schmidt Atlas, pl 291 1913

Valves linear, arcuate, with sides parallel and apices inflated, rounded or subcuneate Striae 9–10 in 10 µ L of v 125–200 µ

Type locality Taunton, Mass.

Distribution· Fresh water Will be found, probably, in New England ponds Fossil in Monmouth, Me , deposit

Illustrations· A Schmidt, Atlas, pl 291, f. 1–3

6 **Eunotia nymanniana** Grun , Van Heurck, Syn. Diat Belg pl 34 1881

Valves arcuate, with sides parallel or nearly so. Apices capitate, constricted and recurved into dorsal elevations. Striae 14 in 10 µ. L. of v 40 µ Terminal nodules as in *E. exigua*. Sometimes considered a possible variety of *exigua*, which, however, has finer striae.

Type locality· Belgium.

Distribution: Fresh water. Local. Near Philadelphia.

Illustrations: Van Heurck, Syn. Diat. Belg., pl. 34, f. 8 (not 10); A. Schmidt, Atlas, pl. 274, f. 9–18; Boyer, Diat. Philadelphia, pl. 13, f. 32

7 **Eunotia pectinalis (Kütz.) Rab. Fl Eur 1: 73 1864.**

Himantidium pectinale Kütz, Bac, 39 1844.

Valves linear, slightly arcuate, attenuated to the subrostrate apices. Striae about 10 in 10 µ, punctate, the puncta in longitudinal rows; 15 in 10 µ on the connective zone. L. of v. to 150 µ The fasciae are often a foot or more in length and associated in masses of a chocolate color

This form is probably not *Conferva pectinalis* Dillw., Brit. Conf. pl. 24

Type locality Europe.

Distribution. Fresh water. Common, especially in the cedar swamps of New Jersey.

Illustrations Kütz., Bac, pl. 16, f. 11, W. Smith, Syn. Brit. Diat. 2: pl. 32, f. 280; Brun, Diat. Alpes, pl. 2, f. 22; A Schmidt, Atlas, pl. 271, f 8, 10, 11, 15, 21–28, Boyer, Diat. Philadelphia, pl. 13, f 6, 7

Eunotia pectinalis undulata Ralfs, Van Heurck, Syn. Diat. Belg, pl. 33, f 17 *Himantidium undulatum* W. Smith, Syn Brit. Diat., 2. pl. 33, f. 281. Valves undulate. Boyer, Diat. Philadelphia, pl. 13, f. 8, 10 With the type *Eunotia pectinalis impressa* Meister, Kiesalg. Schweiz, pl 11, f. 4. (not *E impressa* Ehrenb.) is apparently equivalent to one of the varieties of W Smith. Numerous others might be figured

Eunotia pectinalis stricta Rab, Van Heurck, Syn Diat. Belg., pl. 33, f. 18. Valves nearly straight With the type Not common

Eunotia pectinalis ventricosa Grun., Van Heurck, Syn Diat. Belg., pl. 33, 19 B. Valves tumid in the middle of the ventral side Boyer, Diat. Philadelphia, pl. 13, f. 12. With the type.

Eunotia pectinalis minor Rab., Van Heurck, Syn Diat. Belg., pl. 33, f. 20, 21. Valves 30 µ in length. Striae about 12 in 10 µ. Common in aquaria.

Eunotia pectinalis soleirolii (Kütz) Boyer *Himantidium soleirolii* Kütz., Bac., 39 1844. pl. 16, f. 9 *Eunotia soleirolii* (Kütz.) Rab., Fl. Eur., 1 74. 1864. Differs from the type form in having internal septa arcuate in zone view. As these forms occur with the type it is probable that they are the result of a different method of reduplication and are not a separate species. That they are not sporangial, however, is indicated in some gatherings by the presence of elongated, irregular frustules somewhat tumid in the middle in zone view, and which are similar, in many respects, to sporangial frustules of *Meridion* (Boyer, Diat. Philadelphia, pl 10, f 3) *Meridion* also forms internal cells in the same manner. Not common. Moorestown, N J (T. C. Palmer.) Brun, Diat. Alpes, pl. 2, f 23, Boyer, Diat Philadelphia, pl. 13, f 9, Meister, Kiesalg. Schweiz pl. 11, f. 9.

8. **Eunotia veneris** (Kütz.) De-Toni Syll Alg. 2 794. 1892

Himantidium veneris Kütz., Bac, 40 1844
Eunotia incisa W Smith in Greg Quart Jour Micr Sci 2 96 1854

Valves with convex dorsal and straight ventral margins, slightly incised on the ventral side near the subacute apices. Striae about 16 in 10 µ. L. of v. 25 µ.

Type locality Lake Tacarigua, Trinidad.

Distribution Fresh water. Not common Richmond, Va. (Recent).

Illustrations Kütz, Bac, pl. 30, f 7, Greg, Quart Jour Micr Sci., 2. pl. 4, f. 4; Grun, Verh. Zool.-Bot Ges Wien 12 pl. 3, f. 17; Van Heurck, Syn Diat. Belg., pl 34, f 35, Boyer, Diat. Philadelphia, pl 13, f 30, 31; H L Smith, T S 159

EUNOTIA PROPER

Valves linear, scarcely arcuate, tumid in the middle and at the ends	9	*E formica*
Valves convex on the dorsal, nearly straight on the ventral side Apices broad, truncated	10	*E. praerupta*
Valves arcuate, linear, with parallel sides.	11	*E. parallela*
Valves arcuate, with obtuse ends.	12	*E. monodon*
Valves arcuate with two dorsal elevations	13	*E. diodon*
Valves arcuate, with three dorsal elevations	14.	*E. triodon*
Valves arcuate, with four dorsal elevations	15.	*E. tetraodon*
Valves arcuate on the ventral side, with two dorsal elevations.	16.	*E gibbosa*
Valves arcuate on the dorsal side and tumid in the middle of the ventral side. A pseudoraphe apparent	17	*E. stevensonii*
Valves slightly arcuate, with nearly parallel sides and capitate, recurved apices, bidentate at each end of the dorsal margin	18	*E. bactriana*
Valves arcuate, with the dorsal margin crenulate	19.	*E robusta*
Valves with dorsal margin biundulate and ventral margin straight.	20.	*E. bidentula*
Valves with three dorsal undulations and concave ventral margin.	21.	*E. tridentula*
Valves arcuate, with several slight dorsal elevations.	22	*E. ehrenbergii*

Valves convex on the dorsal side, constricted at the ends which are curved downward.	23. *E. pentaglyphis*
Valves arcuate, with two dorsal elevations and concave ventral margin	24. *E. zygodon*
Valves with biundulate dorsal and concave ventral margin	25 *E camelus*
Valves arcuate, gibbous in the middle of the ventral margin, constricted toward the ends.	26 *E. luna*
Valves narrow, arcuate, tapering to the obtuse apices.	27. *E lunaris*
Valves narrow, flexuose.	28. *E flexuosa*
Valves linear, arcuate in a semicircle.	29 *E. hemicyclus*
Valves linear, slightly arcuate	30. *E. biceps*

9 **Eunotia formica** Ehrenb, Mikrogeol pl 4 1854.

Valves linear, slightly, if at all, arcuate, tumid in the middle and at the ends Striae 10 in 10 µ. L of v. about 45 µ.

Type locality Blue Hill pond, Me

Distribution Waltham Pond, Mass Chicago (Thomas & Chase). Fossil at Monmouth, Me

Illustrations Ehrenb., Mikrogeol, pl. 4, 3, f 19, Van Heurck, Syn. Diat Belg., pl 34, f. 1, A Schmidt, Atlas Pl 271, f 3–5; pl 295, f 4–6

10 **Eunotia praerupta** Ehrenb Ber Akad Berlin, 414 1841

Valves convex on the dorsal, nearly straight on the ventral side. Apices broad, more or less truncated Striae coarse, 7 in 10 µ, punctate. L of v about 70 µ

Type locality Europe

Distribution Fresh water Common in peat deposits.

Illustrations Ehrenb, Mikrogeol, pl. 13, f 15; A Schmidt, Atlas, pl 273, f. 10–28; Boyer, Diat. Philadelphia, pl. 13, f. 5.

Eunotia praerupta bidens Grun Cleve & Grun. Sv. Vet.-Akad. Handl II. 17^2. 109. 1880 *Eunotia bigibba* Greg., Quart. Jour. Micr. Sci, 2: 95 pl. 4, f 3 1854. Valves as in type but with two dorsal undulations. With the type Boyer, Diat. Philadelphia, pl 13, f. 19.

11 **Eunotia parallela** Ehrenb., Abh Akad. Berlin, 126. 1841.

Valves linear, arcuate, with parallel sides and rounded apices. Striae 14–16 in 10 µ. L. of v. 30–80 µ.

Type locality: North America.

Distribution: Fresh water. New England. Ponds in the White Mts.

Illustrations Ehrenb., Mikrogeol, pl. 3, 2, f 11; pl. 4, 3, f. 16; A Schmidt, Atlas, pl. 271, f 6

This form appears to be somewhat indeterminate if all of Ehrenberg's figures are accepted It is given, sometimes, as equivalent to *E arcus*

Eunotia parallela ventralis Grun., Rab, Beitr, Alg 2 3 1865. pl. 1, f 3 c *Eunotia ventralis* Ehrenb, Mikrogeol, pl. 2, 2, f. 25. Valves tumid on the ventral side. Central America West Indies.

12 **Eunotia monodon** Ehrenb Mikrogeol pl 2 1854

Valves arcuate, with obtuse apices Ehrenb, Mikrogeol, pl. 2, 2, f 26, A Schmidt, Atlas, pl 287, f. 1–3, pl. 271, f 13, 14; W Smith, Syn Brit Diat, 1 pl 2, f 16? Smith's figure is said to represent *E. alpina* Kütz

13 **Eunotia diodon** Ehrenb Mikrogeol, pl 2 1854

Valves arcuate, with two dorsal undulations. Ehrenb, Mikrogeol, pl 2, 2, f 31, W. Smith, Syn Brit. Diat, 1 pl 2, f 17; A Schmidt, Atlas, pl 270, f 14–18

14 **Eunotia triodon** Ehrenb Mikrogeol, pl 17 1854

Valves arcuate, with three dorsal undulations Ehrenb, Mikrogeol., pl 17, f 29, W Smith, Syn Brit Diat, 1 pl 2, f 18; A. Schmidt, Atlas, pl 270, f 19–23, Boyer, Diat Philadelphia, pl 13, f. 24

15 **Eunotia tetraodon** Ehrenb Mikrogeol pl 17 1854

Valves arcuate, with four dorsal elevations Ehrenb., Mikrogeol, pl 17, f. 30; W. Smith, Syn Brit Diat, 1 pl 2, f 19; Boyer, Diat Philadelphia, pl 13, f 25

The above four species differ only in the number of dorsal undulations and are variable in size and striation All are quite common in the New England lakes and ponds A great number of figures are given in the "Mikrogeologie" *E diodon*, *E triodon*, and *E tetraodon* are included by Ralfs in *E. robusta*

16 **Eunotia gibbosa** Grun. Van Heurck, Syn. Diat. Belg, pl 35 1881

Eunotia didyma inflata Hustedt, A Schmidt, Atlas, pl 289, f 1, 2

Valves with two dorsal elevations Ventral margin arcuate Apices broad, rounded or somewhat oblique. Striae 12–14 in 10 µ. The terminal nodules are connected by a narrow pseudoraphe L of v. 30 µ

Type locality. North America.

Distribution. Fresh water Adirondacks. Not common

Illustrations· Van Heurck, Syn. Diat. Belg., pl. 35, f. 13

This form is not *Eunotia didyma* Grun In the original material in H. L. Smith, T. S. 654, from Bengal, variations represented in

Grun., in Rab, Beitr. Alg, 2 pl 1, f. 2, (1865), under the name *Eunotia formica* Ehrenb., show outlines somewhat similar to *E. gibbosa*. In *Eunotia didyma* Grun, however, the apices are subacute and the striae are about 6 in 10 µ. In *E gibbosa* Grun. the striae are distinctly punctate and radiate while the pseudoraphe is more or less evident

17 **Eunotia stevensonii Boyer, Bull Torr Club, 47: 69. 1920**

Valves with arcuate dorsal margin and straight or slightly concave ventral margin which is tumid in the middle. Apices broad and rounded. Striae 10–11 in 10 µ, punctate. A sutural line or pseudoraphe extends between the terminal nodules as in *E americana*, *E. clevei*, and others L. of v. 88–113 µ.

Type locality. Pond near Lake Sunapee, N. H.

Distribution Fresh water. Known only from the type locality. Fossil in the Monmouth, Me, deposit

Illustrations. Bull Torr. Club 47 pl. 2, f 12, 13.

18. **Eunotia bactriana Ehrenb, Mikrogeol pl 16 1854.**

Valves slightly arcuate, with nearly parallel sides, constricted at the capitate, recurved apices. The dorsal margin is bidentate, a dentation near each end. Striae 16–18 in 10 µ. L. of v. 35 µ.

Type locality Sweden.

Distribution Fresh water. White Mts., N. H Saco Pond, Me. Tom's River, N. J.

Illustrations Ehrenb., Mikrogeol., pl 16, 1, f 29, 30; Lewis, Proc. Acad Phila, pl. 2, f. 18. 1865; A. Schmidt, Atlas, pl. 270, f 30, 31; Boyer, Diat Philadelphia, pl. 13, f. 18.

19. **Eunotia robusta Ralfs, Pritchard, Infusoria, 763 1861**

Valves arcuate, with the dorsal margin crenulate, the crenae variable in number to more than twenty, usually from 5–8. Striae rather coarse but variable. Apices short, rounded or obtuse. L. of v. varies in proportion to the number of crenae.

E. robusta includes the following forms named as species by Ehrenberg: *E. pentodon*, with five crenae; *E. diadema*, with six; *E. papilio*, six; *heptodon*, seven, *octodon*, eight; *ennaodon*, nine; *decaodon*, ten, *hendecaodon*, eleven; *duodecaodon* and *serratula*, twelve; *serra*, thirteen; *pronotus*, fourteen, *quinaria*, fifteen; *scalaris*, fifteen to seventeen; *bioctonaria*, sixteen, *icosodon*, twenty; and *polyodon*, more than twenty.

Type locality. North America.

Distribution· Fresh water. Common northward.

Illustrations: Ehrenb, Mikrogeol., pls. 2, 17 and 33, many figs.